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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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The Age of Industry.

The average industrialist, and the average founder, as an example, is not conspicuous for the breadth either of his views or of his interests. This is not to deny that there have been and will continue to be numerous founders who are prominent in public life, national or local, and not a few who have risen to considerable eminence. But the great majority find that the running of a works or a foundry is quite sufficiently absorbing of their time, their talents and their energy, and it is not surprising that this should be so. But as a result of this absorption in their own affairs, coupled with the common expression of a grievance to the effect that no one really cares about the woes of industry, a very large part of the community has so far failed to realise that a fundamental change has come over our national life, and a change that happens to concern industrial folk very closely. Its nature may be indicated by comparatively trivial manifestations. Fifty years ago, for instance, no member of the Royal Family would have devoted the greater part of his public time, as the Duke of York does to-day, to speaking at industrial and commercial conferences, opening tunnels and dockyards, etc. Fifty years ago, the industrial peerage, if the term be permitted, was hardly known. Fifty years ago, no young sprigs of the aristocracy took up engineering or went "into the City," or if they did they were extremely careful not to publish the fact. And, more significantly, fifty years ago the Government of the country was primarily concerned, not with unemployment, safeguarding and trade disputes, but with wars and rumours of wars, the Church, the Army and the Colonies. The date is, of course, an arbitrary one, for the process has been at work far more than fifty years. What has happened is that the pivot of our national life is no longer religious as it was in the Middle Ages, nor social as it was in the 18th century, nor political as it became during the 19th century, but economic. And economic, used in this sense, means industrial, three times out of four. Every really important question that arises in national or international politics is primarily an economic question; war debts, tariffs, hours and conditions of labour, emigration, these are all economic and, to a large extent, industrial questions, and they control world politics to a far greater extent than is commonly realised.

There is a school of thought that would deny any such development; a recent writer in a distinguished weekly demonstrated this when he gibed at the "counter-jumpers" who have been given peerages, and made contemptuous use of the old description of the British as a "nation of shopkeepers." These people would like, no doubt, to see the Empire bound by ties of emotional loyalty, and the nations governed by the old diplomacy and the Balance of Power, to the disregard of economic facts. But it will not do. The future lies with industry. Patriotism, enthusiasm, culture, have their place in the future no less than in the past, but it is the economic factor that will be the touchstone. In America this is acknowledged; in Germany this is acknowledged. In Italy it is implied; in France and Belgium it is being learnt. What is Great Britain going to do about it?

An Outstanding Essential.

The disappearance of the Engineers' Club in Coventry Street in London constitutes a loss to the industries for which it catered, which can ill be afforded. We are constantly being asked by prominent Dominion and provincial foundry owners: "Is anything being done to provide founders and engineers with a recognised meeting place in London?" A large number of engineers and foundrymen are to be found amongst the members of the R.A.C., the Constitutional, St. Stephen's and other clubs, but rightly there is insufficient concentration to detract from the avowed objects of their existence. There is a luncheon club in Westminster which has a membership in which engineers largely predominate, but without serious adaptation it could meet the requirements of the engineering and metallurgical professions taken as a whole.

It is not generally realised, nor was it ever officially recognised, that a serious percentage of the defunct Engineers' Club was composed of foundry executives and suppliers, this being especially true of the country membership.

Just before the liquidation the London Section of the Institute of British Foundrymen was considering the advisability of approaching the Committee of the Club for the provision of reserved accommodation for the special use of their members for defined periods. Thus there appears to be a demand both locally in London and nationally for the provision of club amenities for the executives of the foundry industry. The difficulty is parallel to that, which largely contributed to the collapse of the Engineers' Club—lack of initiative. It cannot be expected that such work should be sponsored by the scientific societies, many of which are sorely tried in the task of assuring suitable housing accommodation for their staff and library. This problem has, however, a reasonable chance of solution in the near future. One then naturally turns to the various employers' organisations. Surely it is their duty to assure for the engineering and metallurgical professions a home in London comparable with those organised by their confrères overseas. The Boy-Scout movement, co-operative societies and clubs, both sporting and social, are the three things which Britain has created, and which have spread all over the world. It is a stigma on our profession that London has no recognised meeting place for its members, and is one that should be remedied with the least possible delay.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Compressed Air in Steel-Foundry Practice.

To the Editor of The Foundry Trade Journal.

Sir,—I have read with great interest the article on "Economic Utilisation of Compressed Air in Steel Foundry Practice" by Mr. Barley, and the subsequent discussion. I think the views of one who has spent many years on design of air compressors might interest your readers.

Leakages.—It is not often realised that a small leakage hole can waste an enormous amount of compressed air, for instance, a ¼-in. dia. hole will waste about 100 cub. ft./min. of free air, at 100 lbs. pressure. Assuming the machine is electrically driven and working eight hours per day, six days per week, it would cost about £3 12s. (three pounds twelve shillings) per week for every such hole, of which there may be many in a shop installation.

Condensation in Pipe-Lines.—The extraction of moisture from compressed air, by chemical means, is far too costly for ordinary commercial work, and, in fact, is quite unnecessary. With correctly-designed coolers and separators, even when drawing from a wet atmosphere, the air is so thoroughly dried after compression that no further condensation can take place at the tools, provided the temperature of exhaust does not fall below 28 deg. Fah. For example, 1,000 cub. ft. of moist air at 75 deg. Fah. contains 1.4 lbs. water in the form of vapour. After compression, cooling and separation, only 0.18 lb. will remain, which would allow a theoretical exhaust temperature of 18 deg. Fah., without further condensation. These figures give an idea what can be done without chemicals, and there is the additional advantage that no attention is required, the ejection of water being automatically controlled. The experience of the writer is at the disposal of any of your readers should they require further information.—Yours, etc.,

J. Hendry, A.M.I.Mech.E.

17, Castle Road,
Ipswich.
July 30, 1930.

Book Review.

Recommended Methods for Sampling and Analysis of Foundry Materials. Published by the British Cast Iron Research Association, 24, St. Paul's Square, Birmingham. Price 10s. 6d. net.

The wise chemist will attach as much, if not more, importance to the methods of sampling as to the analytical methods, because, in our opinion, it represents the only sane method of procuring proper raw material for his work, whilst there are other reliable methods of estimating the chemical composition of high-carbon ferrous alloys.

The chemist will encounter nothing of a revolutionary character in recommended methods outlined, but he will find some useful practical tips, such as, for instance, modifications when analysing for carbon in alloyed cast iron, where an increased red-lead addition is indicated.

The estimation of combined carbon in cast iron and similar material could possibly be improved, from a chemical standpoint, by subjecting the specimens to a definite normalising process, but would it then represent the truth when considering the actual material in the state to be investigated? Actually, we favour the subtraction of Gr percentage from the total carbon percentage.

It seems a little pedantic, when reviewing a book destined most probably to become a standard work, to raise the question of nomenclature, but we notice that throughout the expression ml. (millilitre) is used, whereas when we were in charge of laboratories the term c.c. (cubic centimetres) was invariably employed. It would be interesting to learn if there are any good grounds for the change.

We are not too satisfied with the method detailed for the gravimetric method of estimating sulphur. Primarily we feel that the burning-off of the barium sulphate at "red heat" is not sufficiently definite, as excess temperature can vitiate the result. A definite range of temperature should be indicated. Our second comment is that, when dealing with low-sulphur irons, 0.06 per cent. and less, there should be added a definite quantity (say, the equivalent of 0.05 per cent. S in the iron) of, say, potassium sulphate to accelerate precipitation.

The volumetric method devised by Mr. Dews seems quite good, but can "strong, colourless, pure hydrochloric acid" be guaranteed to break up sulphur compounds as they sometimes exist in pig-irons, nickel-chrome steels and the like?

There is on page 13 a note to the effect that fused-silica crucibles are the most economical for ignition purposes. This, of course, reads strange to us, as we normally had a good supply of platinum ware, and, in those days, the porcelain crucibles (of foreign manufacture—no British ones being made) were distinctly better than the fused-silica ware, which was then in its infancy. However, many laboratory conditions were changed during the war.

The final estimation in the book is that of sulphur in fuels, blackings and the like, and we confess that this and the analysis of fluor spar caused us much anxiety, and we feel relieved that a comparatively simple method has been evolved.

For their own sakes, every laboratory catering for the iron-founding industry should procure a copy, as the use of recommended methods, *in case of dispute or anxiety*, will at least simplify and perhaps eliminate any question of arbitration.

The Airship R100.

Messrs. Vickers, Limited, are again identified with an outstanding achievement in the air, the airship R100 being a Vickers' product. Its original construction was financed by the company, who own the whole of the cash capital of the Airship Guarantee Company, Limited, the constructors of the ship. Messrs. Vickers, Limited, also own Messrs. Vickers (Aviation), Limited, who, in turn, own Supermarine Aviation Works, Limited, Southampton. Amongst the numerous records created with machines constructed by this organisation are the following:—

Historic Flights.—1919—First direct flight across the Atlantic: Vickers "Vimy" Rolls-Royce. 1919—First flight from England to Australia: Vickers "Vimy" Rolls-Royce. 1920—First flight to South Africa: Vickers "Vimy" Rolls-Royce. 1920—"Times" African Aerial Exploration Expedition: Vickers "Vimy" Rolls-Royce.

Schneider Trophy.—1922—Winner: Supermarine Napier "Sea Lion." 1927—Winner: Supermarine Napier "S5." 1929—Winner: Supermarine Rolls-Royce "S6."

Speed Records.—1922—World's record, 129.753 m.p.h. (100 kms.): Supermarine Napier "Sea Lion." 1925—World's record, 266.752 m.p.h. (3 kms.): Supermarine Napier "S4." 1927—World's record, 283.669 m.p.h. (100 kms.): Supermarine Napier "S5." 1928—British record, 319.57 m.p.h. (3 kms.): Supermarine Napier "S5." 1929—World's record, 357.7 m.p.h.: Supermarine Rolls-Royce "S6."

To these achievements must be added other notable performances, including the Royal Air Force Far East flight in 1929 of 27,000 miles, from England round India to Singapore, round Australia to Hongkong and back to Singapore, in four Supermarine "Southampton" metal-constructed flying boats, fitted with twin Napier "Lion" engines.

Random Shots.

During the early part of July a congress on welding was held at Zurich, and I understand that very powerful pleas were made for superseding iron castings by welded structures. It was said that welded steel cases are 60 per cent. lighter than castings, and alternatively that the casting must be 2.5 times as heavy as a steel-welded casing.

* * *

Very different views are taken of this question in the industry. Naturally, those engineers who have their own foundries as well as boiler shops can afford to argue that each material should find its economic level, so to speak. So we argue that there is no real competition at all, and that the foundries are better off without the jobs that can be welded, on the ground that, when more than one casting is required from a pattern, the casting is cheaper, and the foundry wants developing on a mass-production and not on a jobbing basis.

* * *

My own view, for what it is worth, is that those who depend on the foundry entirely for a livelihood, and who are not merely partially or incidentally interested in it, should see to it that everything is done in the way of costing, economical production and research to meet the new form of competition.

* * *

I see that a new steel building recently erected at Pittsburgh is entirely a welded structure, and does not contain a single rivet. So the founding industry is not the only threatened institution.

* * *

Doubtless the competition will be good for us. It is not only a matter of cast *versus* wrought metal, but of gas welding *versus* arc welding, mild steel *versus* wrought iron, ferrous *versus* non-ferrous metals, and so on.

* * *

The foundry world does not occupy a large proportion of the world's news, but, after seeing one day this week that 60 per cent. of the foundry workers around Lille were out on strike, I looked with interest at a column headed "Casting Troubles," expecting to see further developments. It related, in fact, to the difficulties of amateur dramatic societies on account of the petty jealousies of players who all thought they should act the leading part.

* * *

And the director of a foundry at Meuselwitzer, in Germany, has found a novel way of committing suicide by jumping into a furnace of molten iron. The news agency said "furnace," but I suspect they meant "ladle."

* * *

Perhaps we ought to turn to something lighter for Bank Holiday consumption. The appearance of the beach at a popular holiday resort reminded me of the story of the man who refused to hire machines that had in them the elements of gambling. The salesman replied that the machines were not gambling devices in any sense of the word, for the simple reason that the customer never stood a chance.

* * *

"But I thought ——," said the typist meekly. "It's not your business to think," snapped the manager; "all I pay you for is to take down what I tell you. Now take this." When the letter came back it read:- "Dear Mr. Smithe, —Don't forget the 'e.' Thinks it's aristocratic. Father was a greengrocer. With regard to your letter of look it up. Why the dickens can't he use a typewriter if he can't write legibly? I can quote you the following prices. Hi, Brown, what shall we stick on for that fellow Smithe? Twenty? Thirty, you say? Right. That's eighteen bob a hundredweight, say £18 per ton f.o.r. works. Awaiting your esteemed orders, I am, yours truly. Thank heaven that's done."

Marksman.

The Use of an Active Gaseous Compound in Effecting Eutectic and Grain Refinement in Aluminium Alloys.

The process of eutectic refinement or modification is generally accomplished by the addition of an element, or compound of that element, in the solid form. As an example of this procedure, the well-known method of the addition of metallic sodium to the eutectic alloy of aluminium and silicon may be quoted, whereby the silicon-aluminium eutectic is obtained in a very finely-divided form, thereby enhancing the mechanical properties of the alloy.

On the other hand, the subject of grain refinement or grain-control in aluminium alloys opens up a new field of investigation which, up to recently, was a region unexplored by the non-ferrous metallurgist.

Fig. 1.—9 per cent. Silicon-Aluminium Alloy, Oil-immersed. × 1,000 Dias.

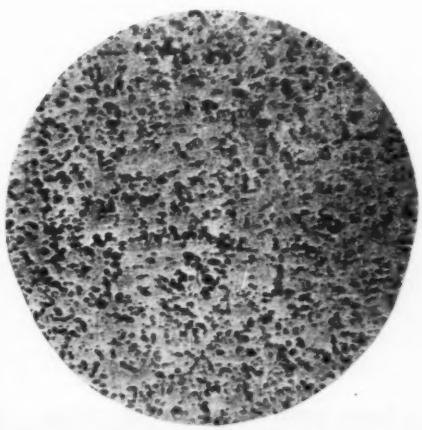


Fig. 2.—Standard 2L5 Alloy refined by the B.C.L. Process.

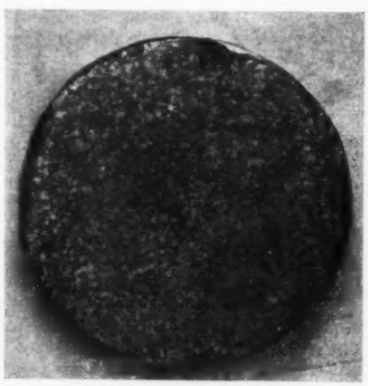


Fig. 3.—Al-Zn Alloy after 10 Reheatings, casting at 950 Deg. C. into a Loam Mould heated to 800 Deg. C.

Principle and Theory of the B.C.L. Process.

The transport and deposition of an element into the metal by means of a gaseous compound gives a more efficient method of producing modification, and at the same time has a similar action on the grain-size of the alloy during solidification. Furthermore, such a method allows of complete control during production on a large scale. The principle of the process under consideration consists in the use of boron trichloride, a chemical compound of an unstable nature, and hence possessing highly active properties.

This compound has the formula BCl_3, boils at 18.3 deg. C., and fumes in moist air, being decomposed in contact with water with the formation of boric and hydrochloric acids, the reaction being exothermic:—$BCl_3 + 3H_2O \rightarrow H_3BO_3 + 3HCl$. Under certain conditions, when the compound is passed, in the form of a gas, through a molten aluminium alloy, the resulting alloy shows greatly improved mechanical properties. The reaction may be expressed by the following equation:—

$$2BCl_3 + 2Al \rightarrow Al_2Cl_6 + 2B.$$

The period of "gassing" is relatively small, and hence the amount of boron contributed to the alloy is insufficient to be detected by ordinary analytical methods.

Effect on Grain Size.

It is an established fact* that the effect produced on aluminium alloys when treated with chlorine gas alone, is to increase the grain size. The action of boron trichloride, however, is of an opposite nature, the grain size being reduced to such an extent as to be hardly visible to the naked eye. As a result of the chemical action, the small quantity of nascent boron deposited in the alloy is sufficient to counteract this undesirable effect produced by the chlorine, which immediately combines with the aluminium to form a chloride, volatile at that temperature.

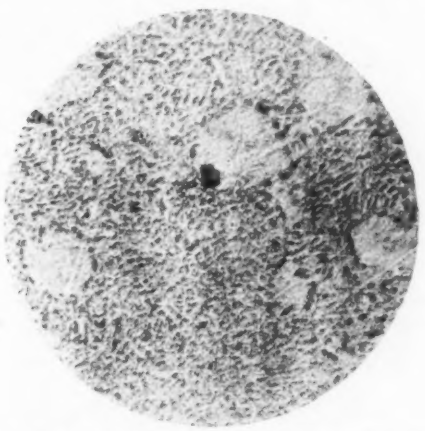


Fig. 4.—Si-Al Alloy modified with Sodium. × 600 Dias.

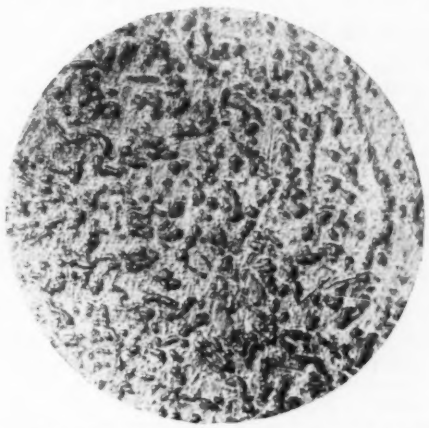


Fig. 6.—As Fig. 4, but treated by the B.C.L. Process and subjected to the same Heat-Treatment.

Fig. 5.—As Fig. 4, but Heat-treated for 1 hr. at 500 Deg. C.

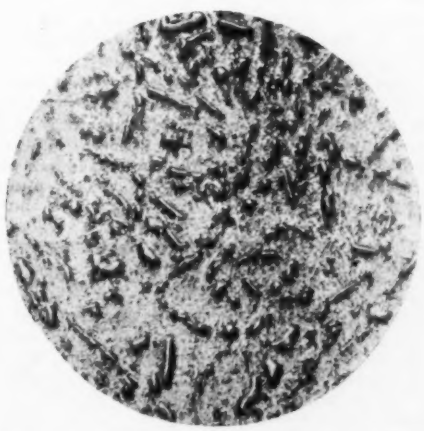


Fig. 7.—As Fig. 5, but treated by the B.C.L. Process.

Effect on Eutectic Formation.

In Fig. 1 is shown a silicon-aluminium alloy containing 9 per cent. silicon, after treatment by the B.C.L. process. The result is similar to that produced by the addition of sodium or any of the other common modifiers in use at the present time. By careful microscopic examination, it has been found that a higher magnification is necessary to resolve the silicon particles in such an alloy modified by the B.C.L. process than for a similar metal modified by the

* D. R. Tullis, "Journal of the Institute of Metals," pp. 40, 59.

addition of sodium, thus showing a nearer approach to the desired colloidal state.

A similar effect has been produced to a lesser degree on ternary alloys of the Al-Zn-Cu type. For example, the alloy 2L5, after treatment with BCl_2, does not exhibit the usual network structure of $CuAl_2$ commonly found in the normal alloy. The structure appears well broken up and well dispersed, the particles of $CuAl_2$ having assumed a globular or spherical condition as shown in Fig. 2.

Stability of Effects Produced by B.C.L. Treatment.

Alloys treated by the B.C.L. process, in order to impart a fine grain throwing capacity, will not, under conditions of remelting, return to their original coarse-grained condition. To illustrate the truth of this statement, Fig. 3 shows a piece of metal which had been remelted many times, and was finally heated up to 1,000 deg. C. and cast into a red-hot loam mould at 950 deg. C. without showing appreciable increase in grain size.

Further experiments were carried out on silicon-aluminium alloys which had been modified (1) by sodium, (2) by the B.C.L. treatment. The specimens under test were heated for 1 hr. at a temperature of 500 deg. C. and annealed. They showed (1) distinct evidence of coalescence of the silicon particles, the structure being completely demodified, and (2) no notable change in the eutectic structure, hence affording further proof to strengthen the claim of the permanence of effect brought about by the B.C.L. treatment.

Properties of B.C.L. Refined Metal.

The properties of B.C.L. refined metal are characterised by: (1) Freezing point increased by a small amount; (2) freezing range reduced; (3) fluidity greatly increased; (4) sand cast metal is not "hot-short," and does not produce cracks or surface fissures; (5) does not produce "pinholed" or "speckly" castings under bad melting conditions; (6) grain size is enormously reduced, from 1 cm. to 10-4 c.; (7) will not return to normal grain size under any conditions of remelting; (8) can be cast into a red-hot mould at 900 deg. C. without showing appreciable grain growth; (9) can be melted at least ten times without showing appreciable grain growth; (10) will not produce "chill" crystals when cast in a chill mould; (11) ductility increased up to 400 per cent., and (12) will impart a fine grain-throwing capacity when added to other similar and normal alloys, even when added in small amount.

Conditions of Working During Production.

The idea of using a compound of chlorine which boils at 18.3 deg. C. for passing through a molten metal is sufficient to strike terror into the heart of the average foundryman. It is sufficient to state that the process has now been in operation for over three years on a production scale, and so far no difficulties have been encountered in this direction. Special apparatus designed for the purpose of gassing the metal has been made fool-proof.

Relative Rates of Reducibility of Iron Ores.—The time required to reduce lumps of iron ore of different sizes to metallic iron is not definitely known. If it could be shown that some ores are more resistive to deoxidation than others, the selection of ore mixtures may be studied more closely. These factors may be important in determining the most desirable sizes of ore for use in the blast furnace. The North Central station of the U.S. Bureau of Mines, in co-operation with the University of Minnesota, is preparing a number of sizes of about thirty different types of iron ores on which deoxidation experiments will be conducted. The various sizes of these ores will be subjected to identical deoxidising conditions at a number of different temperatures within the range, 500 to 1,200 deg. C. The analyses of the resulting materials will show length of time required to metallise various sizes of different types of iron ores.

The Copper Situation.

From a Correspondent.

On April 16 last the price of copper, which had been maintained by the Copper Exporters' Incorporated at 18 cents for twelve months, was reduced to 14 cents, and since that date one cut has followed another until on July 22 the extremely low level of 11 cents was registered, at which point there were signs that the bottom had been reached. Standard copper on the London market steadied at around £47, and even registered an advance of about 25s. within a few days of the 11-cent quotation being reached, while on every hand there was a marked disinclination to open Bear commitments or to maintain short positions. Scrap metals, which had become increasingly scarce and dear in relation to new material as the fall progressed, disappeared almost entirely, on account of holders reluctance to sell at an abnormally low price, while the daily allocations of electrolytic copper, made to Europe by the Export Association, hardly sufficed to meet consumers' needs.

This limitation of the daily tonnage offered for sale by agents of the Export Association seems ridiculous, if it be remembered that stocks of refined copper at the end of the half-year totalled 317,000 short tons, and that these enormous reserves are the main reason for the quotation standing at such a very low level. As long as no alteration in price takes place there is, perhaps, not much harm done, but when a manufacturer is unable to cover sales before a rise takes place his grievance is certainly a very real one. The effect of this doling-out method is usually to panic many buyers, who, in their anxiety to secure cover, begin bidding a premium to outside interests with copper available, as a result of which the market appears much stronger than it really is, and values all round are advanced on a misunderstanding of the real situation. Hard on the heels of such an unjustifiable rise comes the inevitable reaction and a period of stagnation, during which buyers have the leisure to wonder why they were so eager to scramble for supplies of which there are apparently plenty.

The curtailment of copper production in North and South America during the first six months of this year has not been sufficient to combat the falling-off in trade demand, as a result of which stocks have increased to an alarming extent, the comparison being 171,000 short tons at January 1 last and 317,000 short tons on the first day of July. Consumption in the United States has been very disappointing and it was the failure of the normal spring demand to materialise which finally compelled the Exporters' Incorporated to cut their price so drastically in April. Little more than twelve months ago monthly deliveries to users in the United States were averaging nearly 100,000 short tons a month, while exports were running at around 50,000 short tons. In June the American consumers took but little over 70,000 short tons, while shipments fell short of 45,000. In America the decline in the demand for copper has been mainly due to the slump in the motor-car industry, and a very marked falling-off in building-trade activity, events which have checked the call for both copper and brass products. On account of electrical manufactures there has also been a falling-off, but here the decline has not been so marked, either across the Atlantic or in Europe, and, as far as schemes for the extension of electrification are concerned, there can be little doubt that the low price now ruling must bring greater activity.

At the time of writing the quotation for electrolytic copper remains at £52 2s. 6d. c.i.f. U.K. ports, being the equivalent of 11.30 cents, but the buying wave persists and there is every indication that an increase will come, for the price of wire bars on the London Metal Exchange stands at a premium of 17s. 6d. over the Exporters' figure, and metal has actually changed hands at this figure. In view of the adverse statistical situation, it is much to be hoped that for the immediate present 12 cents will prove to be the limit of any upward movement, for a check to the promise of better trade in copper would be fatal. In due course it must be surmised that this metal will achieve comparative stability at about 14 or 15 cents per pound, but it is as yet very early days to think of such a level, and the producers must make up their minds that only a very attractive selling price will enable them to unload their huge accumulation of copper. The 11-cent buying movement was brought about partly because consumers were not carrying much stock and were inclined to put purchases on their books at what was virtually the lowest price for thirty years, but also through the onrush of a wave of sentiment surging back in reaction from months of pessimism regarding the copper situation.

Such a change of heart on the part of consumers after the turn of the year, coinciding as it does with a natural improvement due to demand in connection with autumn trade, does not leave much scope for a reaction in a downward direction, and, in spite of big stocks, an indifferent though slightly improving demand, and the real doubt as to whether stagnation in America will drag on into the spring of next year, it seems very likely that 11 cents will prove to have been the bottom of the fall. Anything sensational in the way of an advance is certainly to be deprecated, and a rapid rise will certainly meet with disaster, but if events prove that the world has passed the low-water mark of trade depression and deflation of commodity prices, then a gradual climb ought to begin in copper values. The situation during the next two to three years can hardly fail to be difficult, for depressions in trade are not overpassed in five minutes, but if the copper situation is rightly handled there is room for a gradual improvement in values which cannot fail to stimulate a healthy demand. During its four years of existence the Copper Cartel has passed through some exceptionally difficult phases, but if the experience gained is properly applied the ensuing period of its activities, provided always that nothing occurs to break up the association, should see the copper situation establishing itself on a solid and satisfactory basis.

Iron and Steel Production.

The National Federation of Iron and Steel Manufacturers in their "Statistical Bulletin" for June report that the number of blast furnaces in operation declined by 8 during the month to 133, and the number of furnaces now blowing is less than at any time since the end of 1928. Production of pig-iron in June amounted to 563,200 tons, compared with 614,500 tons in last May and 657,800 tons in June last year; production in June last year, however, was still on a rising curve, whereas production this year has consistently declined. Production of pig-iron in the first six months amounted to 3,720,100 tons, or 122,200 tons more than in the corresponding six months of 1929. Steel production in June amounted to 600,100 tons, compared with 691,900 tons last May and 830,900 tons in June last year; this is lower than in any month since the coal stoppage of 1926. Part of the decline in the case of steel was due to the Whitsuntide holidays. The output of steel in the first six months of 1930 amounted to 4,361,700 tons, and was lower than in the corresponding period of 1929 by 521,000 tons.

The French Société de Métallurgie Basset reports a further loss of 10,711 fcs. for the year 1929, which brings the total loss up to date to 119,919 fcs.

The Production of Large- and Medium-Sized High-Class Iron Castings.*

By W. Scott.

As the subject of important reciprocating steam-engine castings was adequately dealt with by Mr. J. Smith at the Conference in 1908,† it is my intention to deal only with marine Diesel and steam-turbine castings. Since the advent of the Diesel engine in 1897 and its later adoption for marine purposes about 1905, it has steadily grown in popularity until to-day it stands as one of the most important prime movers. With this development came the need for better cast iron and cast-iron products. It may be said that internal-combustion engines, of the larger class, impose the severest strain of all on iron castings. No Paper on the production of marine-engine castings can therefore ignore the claims of the Diesel engine for consideration.

As may be expected from the combustion of fuel in the cylinder, very high temperatures are reached. In fact, the initial temperature of the gases is between 1,090 and 1,650 deg. C., and it takes little imagination to understand the effect of this on the cast-iron liner, piston dome and underside of cylinder cover. The products of combustion then expand, lose heat in doing useful work and exhaust at between 175 to 480 deg. C., according to type of engine. These figures show the wide range of temperature between the top of the cylinder and the bottom. Furthermore, the initial pressure is in the region of 600 lbs. per sq. in. (greater still in cases of pre-ignition) and exhausts at about atmospheric pressure. The liner is thus subjected to a large range of pressure and temperature and calls for special design, high-class material and perfectly sound castings.

All Diesel engines are subjected to heavy vibrations, due to the nature of fuel combustion, and this is met by providing massive crankcases and bedplates. In one design an engine of 250 tons total weight has 72 per cent. of cast iron.

Fig. 1 shows a typical six-cylinder Armstrong-Sulzer Diesel engine, developing 2,500 h.p., in course of erection, and conveys a good idea of the importance of cast iron. An engineer's description of suitable metal for important castings in a Diesel engine was stated as "a material with the refractory properties of a high-class firebrick and with the strength of high-tensile steel." This should give all metallurgists food for thought.

Mr. W. Scott, the Author of this Paper, is associated with the Close Foundry of Messrs. Armstrong, Whitworth & Company.

Steam-turbine Practice.

Regarding steam-turbine practice, the need for high-duty iron is not so great. Temperatures are lower, there is not the metal-to-metal friction and, owing to the high speed at which this class of engine runs, stresses are generally lower. Owing, however, to the more complicated design generally much skill and forethought is necessary in the production of the main castings. One example, shown later in the Paper, the low-pressure bottom-half cylinder, will suffice to show the main principles adopted in the successful manufacture of turbine castings.

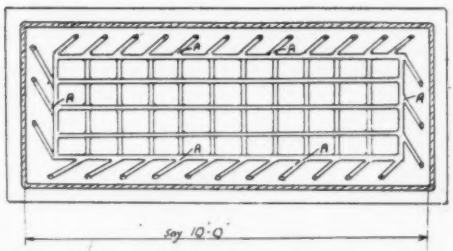


Fig. 3.—The Prod Bars in this type of Core Grid break off at Points "A," and allow of a Natural Contraction of the Casting.

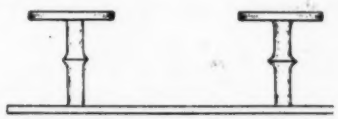


Fig. 4.—Good type of Chaplet.

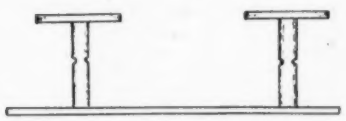


Fig. 5.—This type of Chaplet is not Recommended by the Author.

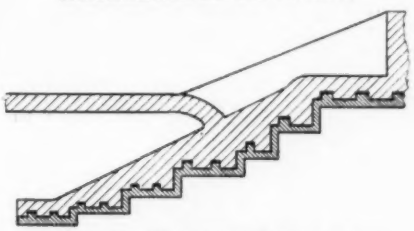


Fig. 6.—Machined Section of Turbine Cylinder Bottom.

* A Paper read before the Annual Convention of the Institute of British Foundrymen.

† "Proceedings," British Foundrymen's Association, 1908, page 49.

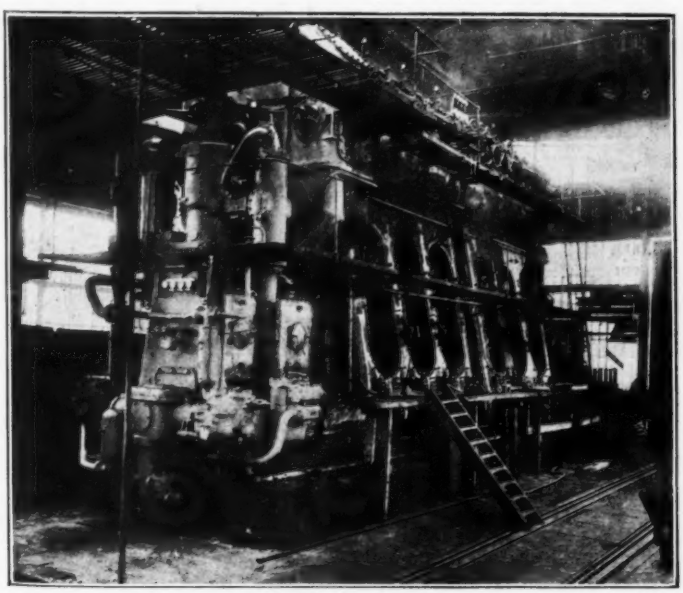


Fig. 1.—Armstrong-Sulzer Diesel of 2,500 h.p. in Course of Erection.

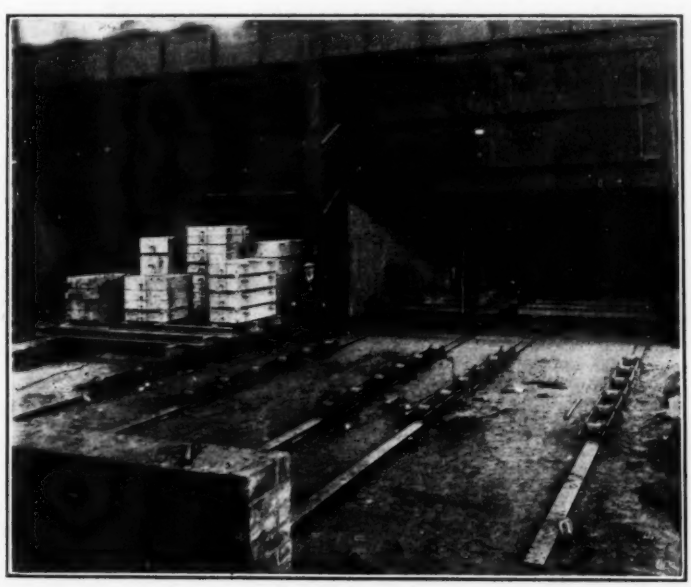


Fig. 2.—Core Stoves at Close Foundry, Gateshead.

To amplify the main points involved in the manufacture of these castings no mention has been made of all the standard operations. For instance, all ramming is hand-done, except in some cases by pneumatic rammer. In the case of the liner and piston skirt, these are being developed for moulding-machine production, but, at the time of going to press, no complete data were available.

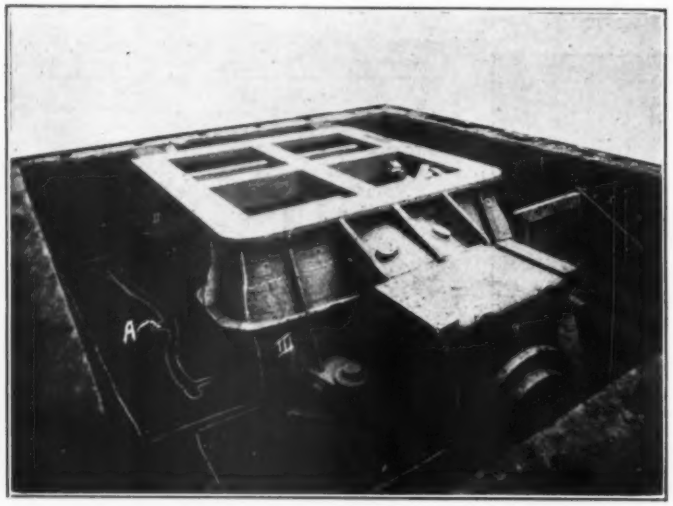


Fig. 7.—Pattern of L.P. Cylinder Bottom bedded in the Pit.

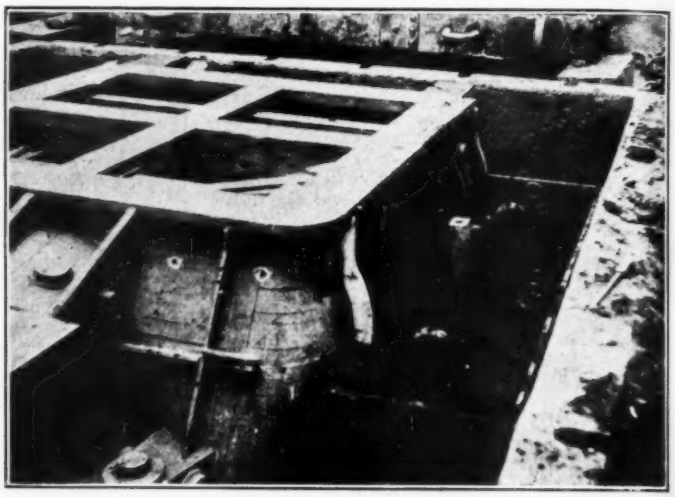


Fig. 8.—Close-up of first Drawback for an L.P. Turbine Cylinder Bottom.

The mould and coremaking times are not presented as record breaking, but actual working times taken from wage records. Should any foundryman engaged on the same type of engines have his times recorded, a comparison for the benefit of all would be welcome. Comparisons are odious, of course, but it is only by some such drastic methods of comparing results obtained by different workers that this country can hold its own in the world of engineering. The time is long past since we held the monopoly, and it behoves us all to improve, improve and still improve.

Sand Preparation.

As all the castings referred to in this Paper are of the dry-sand and loam variety, a few observations might be made on sand preparation. Without entering into extensive laboratory facts (which are not, however, despised), it has been definitely proved that the preparation of dry sand or loam with heavy rolls (as found in the old-fashioned mortar mill) is extremely detrimental to its quality. Sand grain-size is definitely spoiled under these conditions and a big proportion is ground to silt, thus wasting a good raw material and contaminating the whole. Sand so-milled receives more damage in preparation than in its first baptism of molten metal. Loam prepared in such mills will shell off the heavy cores in layers of ¼ in. to ½ in. thick. This is caused through the lack of permeability, owing to excessive grinding, for when first heated, in drying a thin hard skin is formed, which refuses to allow the free passage of steam from the core centre. This skin is then forced from the body of the moist loam by this steam.

The type of mill recommended has rolls mounted on swivel arms and merely ride over the sand, kneading it without grinding. Furthermore, they are tapered on the diameter to prevent any skidding action and weigh only 4 to 5 cwts. each. This taper, in addition to quality production of sand, means less cost for maintenance.

Table I gives the permeability and green-strength tests for raw sand, facing sand and floor sand, as used in the production of the castings. These tests are in accordance with the British Cast Iron Research Association tests on moulding sands given in their Report No. 73.

As will be seen, the floor sand is almost as good on test as the facing sand. As a matter of fact, the facing sand is composed of 75 floor, 25 per cent. new Erith sand and nothing further is added. This mixture when correctly milled and aerated is good enough for almost any kind of iron casting. The sand used throughout is Erith loam, medium strength, and is received in small shiploads of approximately 400 tons.

Mould and Core Drying.

Moulds are dried entirely with portable mould driers, fitted with a twin inlet; that is, from fan to fire. One inlet allows cold air to pass over the fire, and the second to pass under and through the fire. By the judicious operation of the two inlets a large volume of hot air, incapable of burning the mould face, can be blown into the mould. This form of mould drier is very economical in the consumption of coke.

Cores are dried in modern-type stoves capable of registering a temperature of 425 deg. C. Fig. 2 shows the front view of the latest instal-

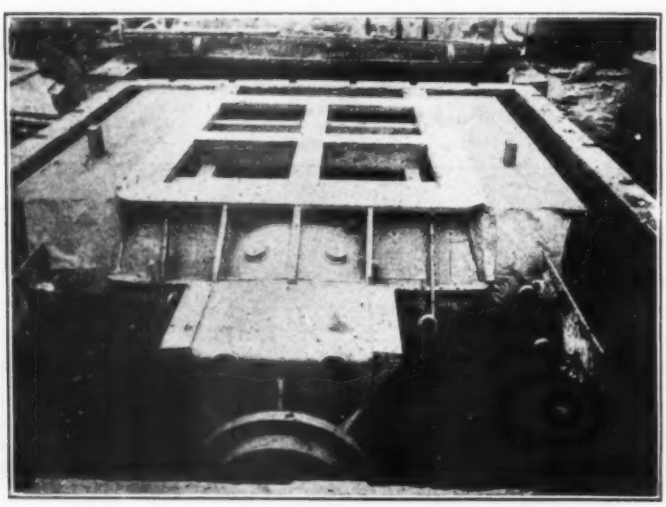


Fig. 9.—The Four Main Drawbacks for the Mould, shown in Fig. 7.

Fig. 10.—Here the Bearing Cores for the Mould (Fig. 7) are in Position.

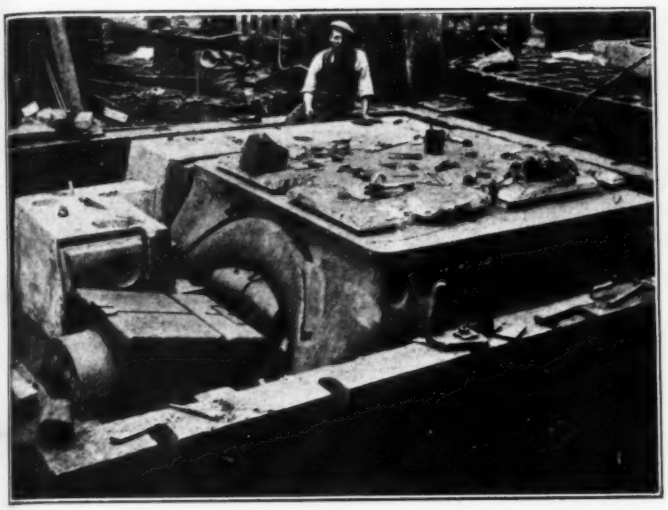


Fig. 11 shows the Main-Exhaust Cover in Position over the Bearing Cores, shown in Fig. 10.

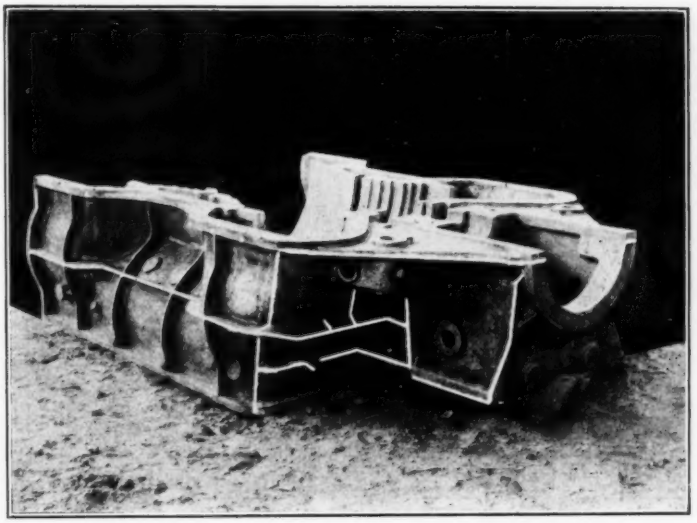


Fig. 12.—The Finished L.P. Turbine-Cylinder Bottom Casting as delivered from the Foundry.

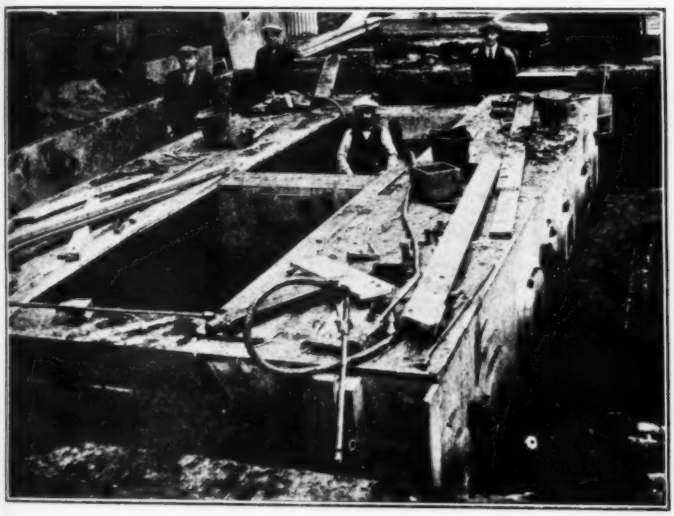


Fig. 13.—Mould for Marine Diesel Half-Bedplate.

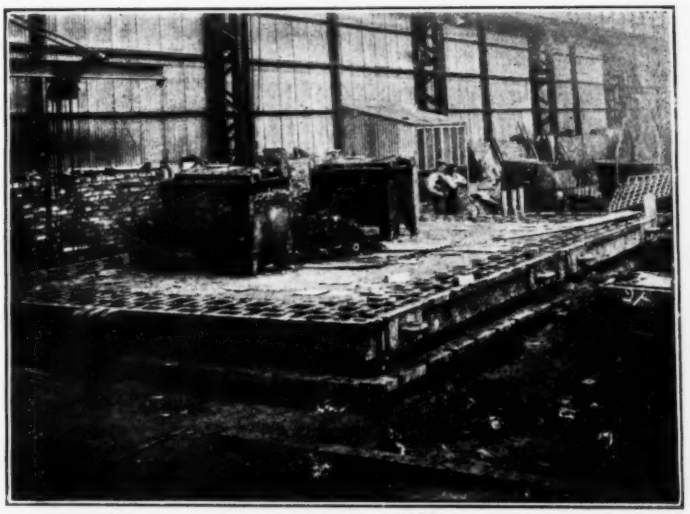


Fig. 14 shows the Method used for Drying the Mould, shown in Fig. 13.

Fig. 15.—Lowering a Quarter Core into Position in the Mould, shown in Fig. 13.

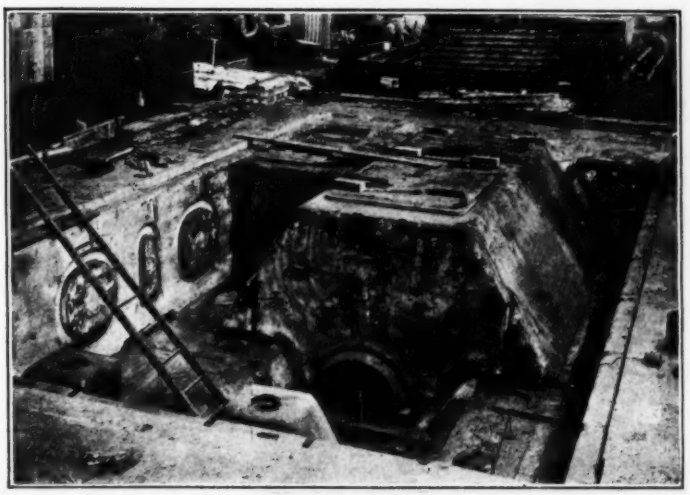


Fig. 16 shows the Main Quarter Core in Position in the Mould, shown in Fig. 13.

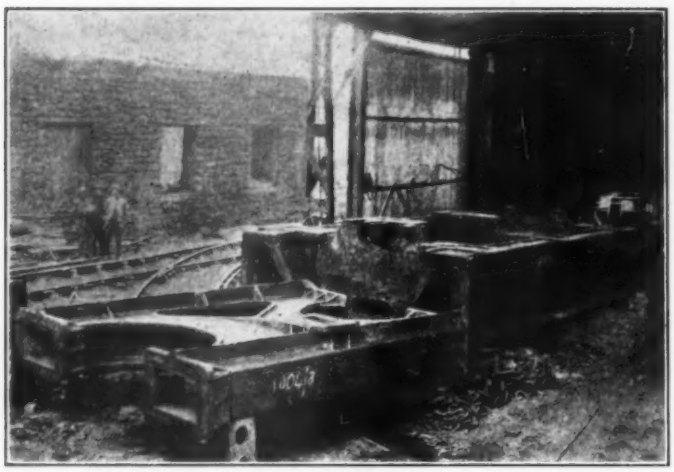


Fig. 17.—Marine Diesel Half-Bedplate and Column in the Dressing Shop.

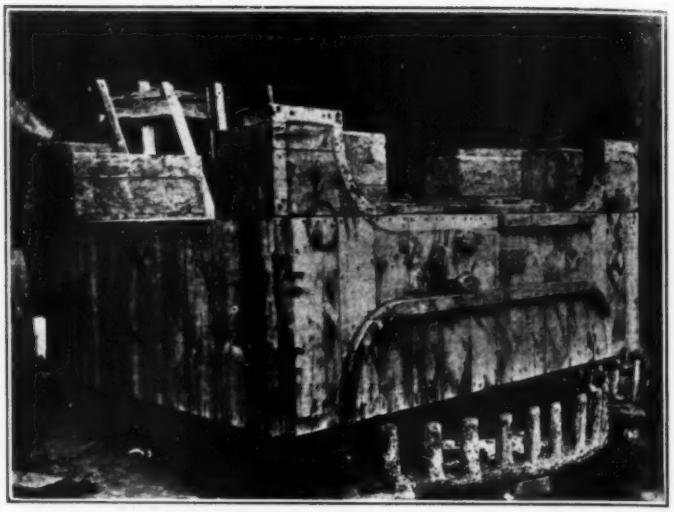


Fig. 18.—This Pattern for a Diesel Engine Column was formerly shaped on the Under Side as on the Top Side. The Alteration brought in Serious Economies.

Fig. 19.—Dried-out Mould for Diesel Engine Column.

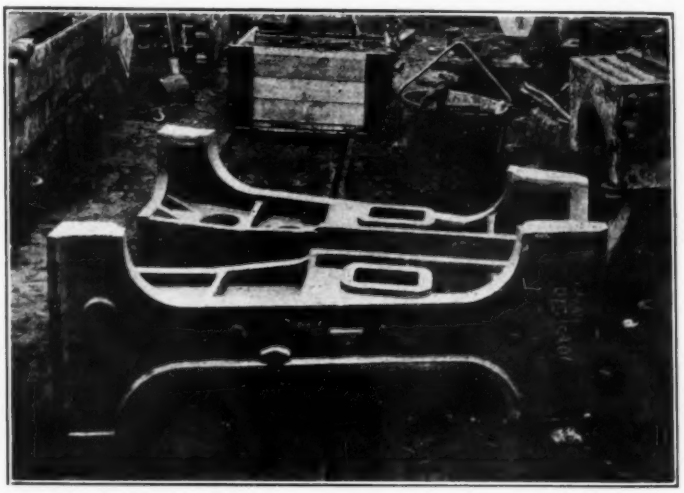


Fig. 20.—Finished Diesel Engine Column Casting.

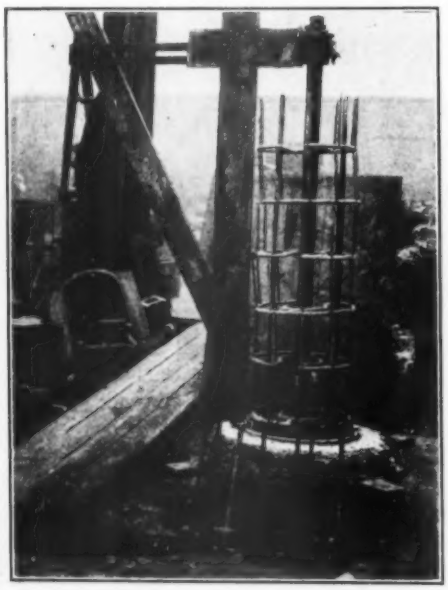


Fig. 21.—Grate for the Main Core of a Diesel Cylinder Liner.

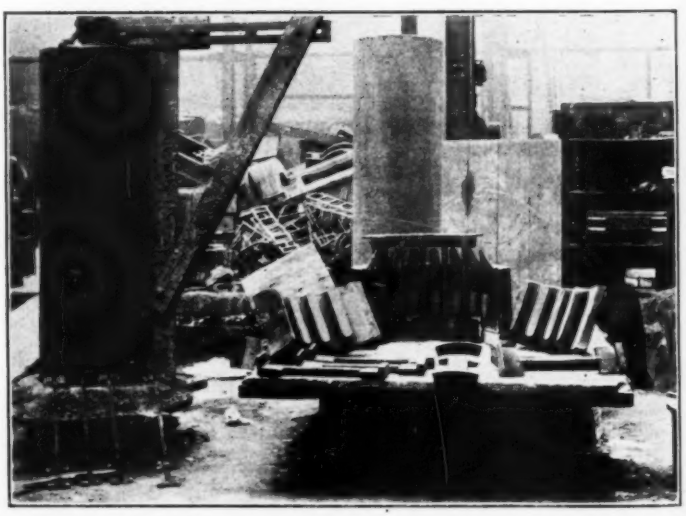
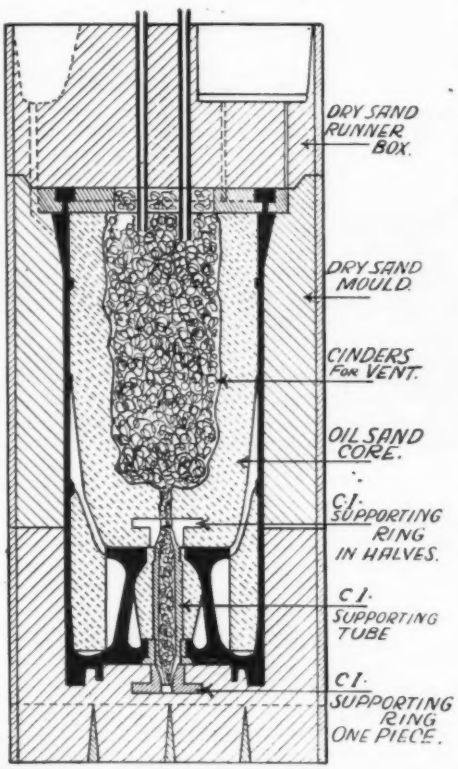
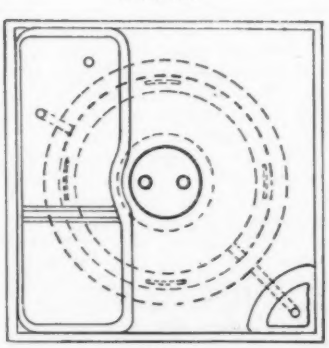


Fig. 22.—Group of Cores for a Diesel Engine Liner.

Fig. 23.—Diesel Cylinder Liner as it leaves the Foundry.



Section.



Plan.

Fig. 24.—Mould for a Diesel Piston Skirt.

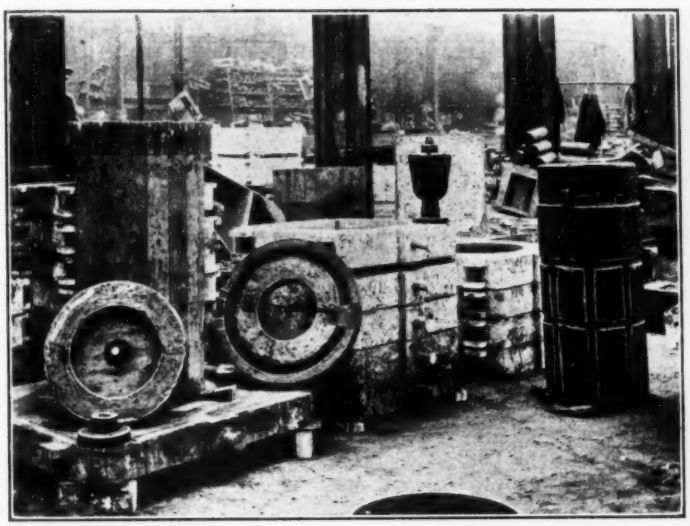


Fig. 25.—Typical Set of Mould, Cores, etc., for a Diesel Piston Skirt.

lation. The bogies depicted therein give excellent "no worry" service, as no lubrication is necessary. Old-type lubricated bearings are a continual source of trouble, owing to the heat burning out the lubrication.

Core Grates.

A few words on this, the neglected side of foundry work, might be appropriate. It is common fallacy to treat these almost with contempt. For instance, spare metal in most foundries is used solely for this purpose. This, in the author's opinion, is entirely wrong. Grates of all kinds should be cast with hot metal

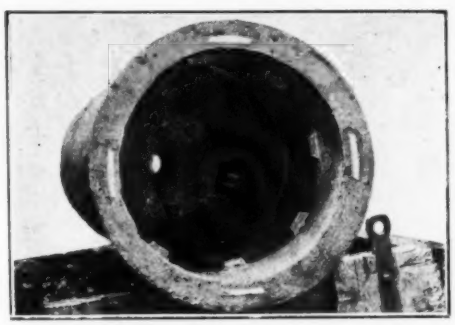


Fig. 26.—Internal View of a Diesel Engine Skirt.

of a suitable analysis to ensure that these are of a correct size when cast. How many times over is the cost of metal wasted in the fettling shop to remove grate bars which are cast thicker than necessary through having been poured with dead metal? Further than that, if such thick grates are used, say, in narrow steam ports, the necessary area of vent space is reduced and may quite easily be the cause of a waster casting. Where intense contraction strains are likely to occur in the casting, the design of core grates shown in Fig. 3 has proved satisfactory. The outer bars break off at the point A where the strains are set up, and thus relieves the pressure.

The man who makes the grates for any large job undoubtedly has to use his brains, for the success of the finished product depends a great deal on the original tackle used. If this fits correctly, and is of the right strength without being too strong, then such important items as vents will naturally follow. Hence the need for the senior man of any squad on a large casting to make this grate question his own particular study.

Chaplets.

The ordinary chaplet as sold in this country is only suitable for work where no pressure of any kind has to be successfully held by the finished product. One is fully aware that pressure castings should be cast at such a high temperature as to fuse fully any chaplets necessary for the proper support of cores. However, it must be readily agreed also that this temperature is sometimes sufficient materially to weaken or entirely to melt the chaplet and allow the core to lift, leaving a thin wall. On the other hand, castings are poured at temperatures which do not fuse the chaplets whatsoever, resulting in a rejected casting due to "leaking at chaplets." To assist this latter case, it would be beneficial to founders as a whole to adopt the shape of chaplet stalk, shown in Fig. 4, instead of the present type, shown in Fig. 5. The thin projection on the suggested type is soon fused, whereas cold metal will not flow into the recess on the other kind. Furthermore, the stalks of the first kind cannot be punched out owing to the projection, and, should slight leaking take place, riveting over of the ends can be accomplished quite easily.

Table I.—*Average Tests on Sands Used.*

Permeability Test (Gas Pressure, 7 cms.).

Sand.	Moisture content.	Weight of core.	Apparent density.	Time of permeation
	Per cent.	Gms.		Secs.
Facing ..	8.2	1223.5	1.53	44
,, ..	8.2	1193.75	1.49	41
,, ..	8.2	1200.75	1.50	42
Floor ..	12.06	1227.25	1.53	44
,, ..	12.06	1253.5	1.57	48
,, ..	12.06	1216.7	1.52	47
Raw Erith..	14.3	1303.2	1.63	200
,, ..	14.3	1238.2	1.55	277
,, ..	14.3	1286.2	1.61	193

Compression. Strength of Sands.

Sand.	Weight of core.	Load ozs. breaking.
	Gms.	
Facing	56.1	93
,, ...	57.5	98
,, ...	57.7	99
Floor	61.6	80
,, ...	63.0	84
,, ...	62.0	81
Erith	63.0	142
,, ...	63.4	143
,, ...	63.6	144

Fig. 27.—Pattern for Diesel Cylinder Jacket.

Fig. 28, showing the first Portion of the Cope for Diesel Cylinder Jacket in Position.

L.P. and Astern Turbine Cylinder Bottom.

This casting, although only a low-pressure type, is sufficiently complicated in wall thickness, etc., to warrant special mention. Thirty lbs. per sq. in. can be a difficult pressure to hold when sections are machined as shown in Fig. 6.

Fig. 7 shows the pattern set on its prepared bed in the pit and is cast inversely to the position occupied when in service on the turbine. An outline of the drawbacks is shown by white lines, and they are divided up in the manner shown, principally for ease in the setting of cores. This casting must be run on both sides, one of which is shown in the centre of drawback marked I. The down-gate enters at point A, which, it will be noted, is not directly opposite an ingate. It is bad practice to have this otherwise. The runner channel is also carried 6 in. to 8 in. past the last ingate at both ends. This is to allow room for the detention of any scum which might pass down the down-gate at the first inrush of metal.

Fig. 8 shows a close-up of the first drawback. The down runner peg is clearly shown, also the lifting eyes, which are cast in the bottom drawback plate. These drawbacks are loam-faced. This is considered extravagance in some foundries, but the results obtained by this method easily repay any additional cost. Fig. 9 shows the four main drawbacks, finished-rammed, and drawbacks marked III on Fig. 7 in course of ramming-up.

Reading from the left of Fig. 10, the bearing cores are in position, then the main-expansion cores, and in the centre and over these cores is seen the steam-inlet core. In each case the staple-holes are rammed up and *dried* before proceeding with the overlapping coring. The vents for the main-expansion core are led downward in the centre and at the far end into the bottom ash-bed, and thence to the corners of the pit and out.

Fig. 11 shows the main-exhaust cover in position over the last-mentioned cores. The plate in evidence is merely used as a stiffener for lifting purposes. This core is of such an awkward shape that immense distortion takes place in handling if this is not used. Before placing in position the top box, the plate is removed and the vents connected through the top direct.

Fig. 12 shows a finished low-pressure turbine-cylinder bottom as delivered from the foundry, with the outline of the drawbacks shown by white lines. This casting weighs about 5½ tons, takes 350 hours moulding time and 330 hours coremaking time. The final analysis of the metal in the casting shows:—T.C. 3.2, Si 1.8, Mn 0.7, S 0.09 and P 0.4 per cent. The tensile strength was returned as between 14 to 16 tons per sq. in.

Marine Diesel Half-Bedplate.

This casting is not included in the Paper for its complications, but as a standard plain, large casting one always associates with heavy marine work. It is typical not only of the Diesel but the ordinary steam-reciprocating design as well. As will be seen from Fig. 13 it is a large job, measures about 23 ft. by 16 ft. Most of the

Fig. 29, showing the Relative Sizes of the Head and the finished Jacket Casting.

plain ramming is done by pneumatic rammer, shown in the foreground. The two main quarter cores are rammed-up inside the pattern and are carried on quarter plates, which, in turn, rest on the prepared print, well below casting level. This is a vital factor in allowing the natural contraction of the bedplate after casting. The large holding-down bar seen on the right-hand side, partly rammed-up, was a precautionary measure to distribute the pressure of metal when casting. This was a new pit, requiring added care for its first cast. Also, on the same score, four plates were rammed in at each corner and are shown at top and bottom right.

Fig. 14 shows how the mould was dried. Two hot-air driers were used for 24 hours and consumed approximately 24 cwts. of cheap coke. The top box for this pit is shown clearly here and is in two parts, each 18 ft. by 14 ft. The experience gained on this pit points to the necessity for an increased depth of top box. The author in making future tops of this size would make the depth 15 in. minimum. When turning over at present these boxes have a certain amount of deflection, detrimental to safe manipulation. All bedplates of this design are run from the bottom, the metal entering into the heavy section around the crankshaft bearing, via a down runner through the main quarters. This is already shown at A on Fig. 15, which depicts a quarter core being lowered into position.

Fig. 16 shows the main quarter core in position, with part of the main girder cores erected in place. As these castings are made to 5 per cent. on estimated weight from drawing, great care has to be exercised in obtaining the correct thickness. Often it is necessary to rub off as little as ⅛ in. from the whole face of a quarter, as shown, to obtain this.

Fig. 17 shows the finished casting in the heavy-dressing shop, flanked on its left with a column for the same design of engine. This view somewhat dwarfs the casting, but was taken for another purpose. The bedplate casting weighs 27 tons and took 640 hrs. moulding time and 380 hrs. coremaking time to produce. The analysis of metal used was:—T.C. 3.3, Si 2.0, Mn 0.6, S 0.09 and P 0.8 per cent. The tensile test showed 11 tons per sq. in.

Diesel Engine Column.

This column is included to raise, if possible, a discussion on the modern trend to block out patterns. Probably in ten years from now 95 per cent. of all patterns made will be entirely blocked out, the actual shape being formed with cores. This is a considered opinion, and may appear here as a form of forecast of future developments. The natural development of all machinery designs is for simpler, cleaner looking externals, with more complicated internals. Take, for example, modern fixed lathe-headstocks, motor-car engines, motor-car bodies and marine engines generally; in each case the finished product is approaching the "plain-van" appearance, as the advertisements say. This, then, is furthering the tendency to make patterns into plain boxes, with the whole of the vitals formed by cores. The pattern shown in Fig. 18 was originally shaped on the under side

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with Turnover Pattern Plate.

For Pneumatic Power.

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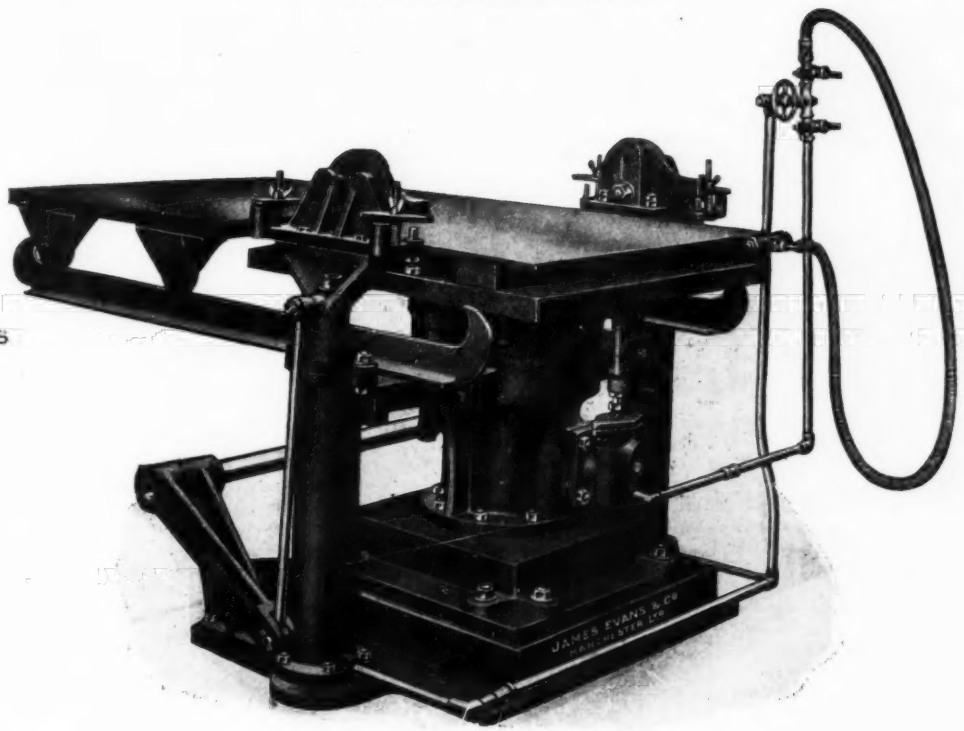

UNSKILLED LABOUR ONLY REQUIRED.

The above machine illustrates a Jar Ram Machine with Turnover Pattern Plate which can also be used for Stripping Plate Work.

The machine has been designed to combine the two distinct features above mentioned, and is practically two machines in one, equally suitable for steel, iron, etc.

The machine as illustrated is arranged for work that requires turning over, such as steel moulding. And while the turnover arrangements are intended for general repetition work, by detaching the turnover plate from the trunnion brackets the machine can be used for stripping plate work by attaching the stripping plate to the trunnion brackets. Or, on the other hand, by removing the trunnion brackets as well, the table can be used for jolting general jobbing work.

A very important feature of the machine is the simplicity with which the intensity of the Jolt can be regulated when the operator has become accustomed to the use of the machine, which takes but an hour or so. The valves all being on the exterior of the machine are easily accessible, and there is an adjustable arrangement that will allow the jolt to be varied between 1½ in. to below ½ in. This being done without disturbing any part of the machine.

The machine is supplied with Withdrawal Carriage, Vibrator, and Blow-off Nozzle complete. It is substantially constructed to stand heavy wear and tear, and requires a minimum amount of skill to operate.

Another important feature of the machine is in the arrangement of the hard wood anvil block for receiving the shock. The blocks being carried well down the machine in a specially designed annular chamber give considerable relief to the foundations. It also provides against the possibility of fracturing the jolting table. Pitch pine blocks are also inserted between the foundation plate and the machine bedplate to assist in the relief on the foundations, and these features considerably improve the working advantages of the machine.

IT IS ALSO ENTIRELY OF BRITISH DESIGN AND MANUFACTURE.

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similar to the top side, but as a trial was blocked out as shown. This alteration has affected the job as follows:—

—	Before blocking out.	After blocking out.	Hours saved.
	Hours.	Hours.	
Moulding time.. ..	186	160	26
Coremaking time ..	140	130	10
Closing time	32	31	1
Fettling time	86	60	26
Total	444	381	63

The casting is generally better looking and a much quicker turn-over of castings followed.

Fig. 19 shows the mould immediately after drying. Two of the four ingates are clearly seen on the back vertical wall. The finished casting (Fig. 20) weighs 6 tons 10 cwts., and is what moulders generally call a "handy lump." The metal used for this casting is similar to analysis for turbine cylinders, viz.:—T.C. 3.2, Si 1.8, Mn 0.7, S 0.09 and P 0.4 per cent.

Diesel Cylinder Liner.

This casting, together with the piston head and cover, constitute the very heart of a Diesel engine, and upon the quality of this material throughout depends the success of any make of combustion engine. Temperatures momentarily under working conditions reach over 1,090 deg. C., and the slightest flaw is magnified until a breakdown occurs. It is, therefore, essential that consistent analytical results are obtained daily. To ensure this, the author's firm have found it necessary to manufacture refined iron of guaranteed analysis and physical properties. This pig is tough, close grained and forms the basis for the manufacture of this and similar castings.

The mould for this casting has nothing unique in its manufacture and therefore is not shown. The pattern is the usual solid type and is built up on fairly standard lines. The grates for the main core are shown in Fig. 21, and are cast with a slot in the rings to enable them to be put in place, as the core is built, without dismantling the sweep gear.

The core irons for the cooling-water passages are shown in the foreground. These must be of cast iron, otherwise will bend when surrounded by metal. Fig. 22 shows a typical group of cores and include two main cores—one green, one dried—scavenge and exhaust-passage cores and cooling-water-passage cores. The scavenge and exhaust-port cores are made to leave a flash of metal $\frac{3}{8}$ in. in thickness where they approach the main core. This is to prevent a collection of scum on the bottom edge of the port as cast, and to enable a clean-cut edge to be made after the boring operation. It also allows a clear space for the metal from the drop runners to pass.

The setting of the main core is interesting. This is made hollow, and when placed in the mould dry sand is placed in the bottom. To adjust the vertical thickness in any direction this sand is tucked under the bottom by a long rammer, thus quickly altering the angle at which the core is lying and correcting the thickness.

This liner is poured through six $1\frac{1}{4}$ in. by $\frac{1}{4}$ in. gates at the top, equally spaced around the periphery. The depth of head is 12 in. The cooling-water-passage cores are made of steel-moulders' composition. Owing to the fact that these castings are poured as hot as possible, these cores, if made with oil sand or ramming loam, by reason of the excessive temperature of the metal around so small an amount of sand, fuses it into a stone-like mass and entails excessive time to remove them. The ladle used for casting is always a bottom-poured steel-caster's ladle, for added cleanliness. The finished casting is shown in Fig. 23.

The analysis of this casting is:—T.C. 3.1, Si 0.8, Mn 0.7, S 0.10 and P 0.3 per cent. The moulding time was 50 hours, whilst coremaking absorbed 47 hours. The weight of casting, with the head, was 1 ton 18 cwts.

Diesel Piston Skirt.

This is included here to show a rather novel method of manufacture to eliminate all chaplets. The cross-sectional sketch, Fig. 24, of the mould, complete with its cores, is almost self-explanatory. As this casting is machined all over outside and must be entirely free from defect of any kind, it is necessary to take special care to eliminate any dirt inclusion.

The supporting ring, tube and upper ring in halves are machined accurately to size to ensure correct wall thicknesses in the skirt. The bottom ring is rammed up in position in the bottom-half mould and the top (in halves) in each half of the main core (oil sand). The tube, with holes drilled at intervals, forms a direct vent from this intermediate core into the main vent. This main vent is then carried through the top box by tubes. The cast-iron supporting tube invariably reduces in length $\frac{3}{8}$ in. after being used six times. The runner appears complicated, but results since its adoption have justified the additional trouble. The runner basin is filled before lifting the plugs, and clean metal is drawn off into the circular channel, formed by a loam coro. The metal then enters the mould through direct drop gates, four in number, and measuring 3 in. × $\frac{1}{4}$ in., the position of these is carefully marked out to obviate any undue splashing on the mould or core face.

A typical set of moulds and cores is shown in Fig. 25, and includes the pattern; core to form the runner channel with down-gates showing mould; intermediate core standing in the metal ring, and main oil-sand core complete.

The oil sand used on this core and, for that matter, throughout the lighter side of the foundry, is composed of 30 parts sea-shore sand to 1 part linseed oil. No other ingredients are added. Cores made thus have little or no green bond, but when baked are the best possible. They vent freely, run out like a liquid after casting, will not absorb moisture and generally give entire satisfaction. The internal view of this casting is seen in Fig. 26, with runners shown chalked. The self-feeding head is 8 in. high.

The weight of casting is 18 cwts., the moulding time 28 hours and coremaking time 40 hours. The analysis of the metal in this casting showed:—T.C. 3.2, Si 1.4, Mn 0.7, S 0.1 and P 0.3 per cent.

Diesel Cylinder Jacket.

This casting is one of the high-duty iron class and is made in some parts of the country in a manner precisely opposite to the one depicted here. In this method the explosion end of the cylinder is cast to the top. This matters little, however, as the liner mentioned previously takes the brunt of the heavy duty. However, a perfectly sound casting is still necessary at this point and this is ensured by the use of a heavy-self-feeding head of metal 18 in. high. This head is not shown on Fig. 27, which shows the body of the pattern sitting on the rammed bottom box. The two ingates are shown marked in white and measure $3\frac{1}{2}$ × $\frac{3}{4}$ in. This method of manufacture was used to simplify the coring-up, which is now a comparatively quick operation. Fig. 28 shows the first portion of cope in position, with the main core forming the water-jacket space. In passing, it should be pointed out that these boxes were not made for the job, but are locomotive-cylinder boxes adapted, hence the journal spaces shown.

Fig. 29 shows the finished casting and gives a good idea of the head sizes proportionately.

Lancashire foundrymen will no doubt not admire the skin on this casting. It compares badly with some of the textile green-sand work produced there. However, when one is dealing with large volumes of 0.8 to 1.00 per cent. silicon iron, cast at 1,350 to 1,370 deg. C., one is more concerned with the internal soundness than the external appearance.

The casting weighs $5\frac{1}{4}$ tons with head, and has an analysis of:—T.C. 3.2, Si 0.9, Mn 0.7, S 0.12 and P 0.3 per cent. The moulding time is 75 hrs., whilst coremaking occupied 95 hrs.

Finally, the author would like to pay tribute to the skilled craftsmen employed in this class of work. The loam moulders call for special mention, as it is with them that the successful manufacture of high-class castings, apart from the repetition class, of course, depends chiefly. Supervision may be of the best, but can never entirely replace clever craftsmanship. Imagine the result of a man-in-the-street's efforts to produce a work of art under expert guidance. Its value would be nil. These men rank in the same class as the artist. Foundry supervision must enforce discipline, supply the right materials at the right time, and prevent overlapping of efforts; the remainder depends on the craftsmen themselves, at any rate so far as large castings are concerned.

In conclusion, the author would like to express his thanks to the directors of Sir W. G. Armstrong, Whitworth & Company (Ironfounders), Limited, for their kind permission to publish this Paper.

Progress in the Manufacture of Rustless Steels.

In a Paper, presented to the Liége Mining and Metallurgical Congress, Mr. J. H. G. Monypenny remarked that chrome and chrome-nickel steels were the first kinds to be used for resisting corrosion, and for many purposes they still give perfect satisfaction. The necessity, however, of obtaining a steel capable of withstanding increasingly severe types of corrosion has stimulated research for new proportions in the alloy content, generally richer and naturally more costly. The present brief review is intended to give an account of the progress achieved in this direction and the difficulties that have had to be overcome in producing these grades of steel.

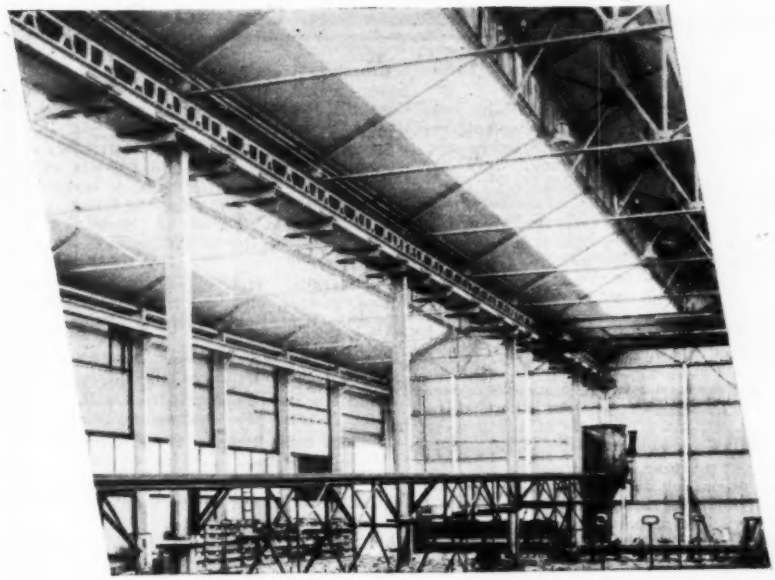
As chromium is the principal element in the composition of rust-resisting steels, it was very natural that the idea of increasing its original content (12 to 14 per cent.) should be adopted for the purpose of obtaining a more resistant surface. Research in this direction gave satisfactory results, but, unfortunately, high-chromium iron and steel do not always possess the mechanical properties required. Great progress, however, has been made in the manufacture of high-chromium steels, among which may be mentioned hardening steels, which, after undergoing suitable heat-treatment, show high ultimate strength and excellent mechanical properties, and mild steels, which are specially suitable for use in plants for the production of chemical products.

The chrome-nickel austenitic steels discovered by MM. Strauss and Maurer are widely used in the construction of plant for the chemical industry and possess noteworthy merits, but it has been found that certain manufacturing processes, such as welding, considerably reduce their resistance to chemical attack and may produce intercrystalline rupture. This defect may be remedied by subjecting the complete apparatus to a certain heat-treatment after manufacture, but this method frequently presents difficulties.

The steels just mentioned contain a percentage of nickel just sufficient to render them austenitic. For special purposes they may have a higher nickel content, and the special properties thereby obtained are described by the author. Remarkable progress has been made by making additions of other metals (such as copper, molybdenum, tungsten) and silicon, to austenitic steels, and this has resulted in the production of alloys showing greater resistance to attack by certain chemical products.

XUM

F.T.J. 7/8/30.



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Trade Talk.

Messrs. Edward Sisterson, Limited, iron and steel merchants, have removed from St. Nicholas Chambers to 54, Grey Street, Newcastle-upon-Tyne.

Messrs. Midgley & Son, Limited, 21, Change Alley, Sheffield, have been appointed by the Armco International Corporation as sole selling agents in the North of England and Scotland for "Armco" ingot iron.

The Wellman Smith Owen Engineering Corporation, Limited, Victoria Station House, London, S.W.1, have, through their South African house, been awarded the contract of the Anglo-American Corporation of South Africa, Johannesburg, for the supply of two-ladle cranes, each of 80 tons lifting capacity, for delivery to M'Kana, Northern Rhodesia.

Metropolitan-Vickers Electrical Company, Limited, have opened new offices in Manchester, their address now being Ship Canal House, King Street, Manchester. The telephone numbers are City 6230/1/2, and the telegraphic address is "Multiphase, Manchester." A new depôt has also been opened for the sale of their "Cosmos" lamps at 3, Victoria Bridge, Manchester.

The Société des Aciéries Electriques d'Ugine-UcKange, a new company formed jointly by the Société des Aciéries Electriques d'Ugine and the Société des Forges et Aciéries de Nord et Lorraine, is soon to begin the equipment of its electric steelworks. The plant, which is to produce special steels, will be situated near the works of the Société des Forges et Aciéries de Nord et Lorraine, which will provide the pig-iron.

Mining & Industrial Equipment, Limited, 11, Southampton Row, London, W.C.1, report that new orders have been received for the following equipment:—For England, one Hum-mer screen; for France, seven Hardinge ball mills, a "Baby" Raymond mill, two Raymond pulverisers and three 4-ft. by 7-ft. screens; for South Africa, three "Impax" pulverisers; for India, an "Impax" pulveriser; and for Canada, an 8-ft. Hum-mer screen.

Arrangements are pending for the production under Sheffield patents of drill steel in the Transvaal by a company to be styled the Pretoria Forge & Rolling Mills, Limited. A large percentage of the drill steel used in the Witwatersrand is under the patents of Mr. J. Kendrick, of Sheffield, who is to become rolling-mill manager of the new company for five years. The works will adjoin those of the South African Iron & Steel Industrial Corporation, Limited.

According to a cable from Johannesburg, the directors of the projected State steelworks in South Africa were faced with an awkward situation when they opened tenders for the construction of works at Pretoria. They found that America had not tendered, leaving only Britain and Germany. From these countries only one tender was acceptable, and that, if accepted, would entail an expenditure of £1,250,000 in excess of the estimate. The plans are now likely to be reconsidered.

A Commercial Mission is to be sent by the Government to the Far East, its terms of reference being "to inquire into the present condition of British trade with China and Japan, and to report what action should be taken to develop and increase that trade." The members of the Mission are:—Sir Ernest Thompson, J.P., Sir Thomas Allen, Mr. James Bell, J.P., Mr. William A. Crowther, J.P., Lieut.-Colonel Reginald Morcom (Messrs. Bellias & Morcom, Limited), and Mr. Louis Beale. The secretary is Mr. T. St. Quintin Hill.

Bad trade is responsible for 140 men employed at the Trent Ironworks of Messrs. John Brown & Company, Limited, at Scunthorpe, having received a fortnight's notice to cease work. The men are, however, being kept on, as far as possible, on day-to-day terms so long as work in hand is available. There are two blast furnaces in work at present at the works, but it is expected one will shortly close down unless there is an improvement in trade. Trade in the iron and steel industry of the district is very slack. Only recently the North Lincoln Ironworks were closed down indefinitely, throwing some 330 men out of work.

The summer meeting of the Whitworth Society was held at Crewe on Tuesday, July 29. Mr. W. H. Fowler (Manchester) presided at luncheon, and inducted into the chair Sir Henry Fowler, chief mechanical engineer of the L.M. & S. Railway Company, the new President of the Society. It was announced that the Society had made a grant of £25 to the Royal Technical College, Glasgow, to be expended in Whitworth Society prizes, and the founder of the Society, Dr. Hele-Shaw, explained his proposals for the future allocation of such prizes. The luncheon was followed by an inspection of the Crewe locomotive works, under the guidance of the President and members of his staff.

Accompanying the report of the Duffield Iron Corporation, Limited, is a letter to the shareholders, which states that the retort furnace was lighted for the first trial on Monday morning, July 21, and continued till Tuesday evening. Upon charging the retort with a mixture of pulverised coal and iron ore, it was found that the gas evolved was more than sufficient for the requirements of the retort. This, the letter states, establishes the claim of the invention as expressed in the prospectus, namely, sufficient gases are generated in this reaction to supply the whole of the heat necessary for the making of iron. The test revealed that the mechanism in some respects needs improvement, and the running of the plant was stopped to effect this. "It appears evident from the information afforded by this demonstration," the circular concludes, "that the main principle of the process is capable of definite establishment."

Among the extensions contemplated by the Algoma Steel Corporation at their Sault Ste. Marie (Ontario) plant, following the recent changes in the rates of duty levied on imported steel products, is the improvement of the existing rail mill. The proposed mill will be a 28-in. mill throughout, and heavier stands and rolls are to be substituted for the existing equipment. The mill will be driven by an electric motor in place of the present steam engine, and the larger mill will enable the company to roll rails up to 130 lbs. per yard, as well as certain structural sections, such as standard beams and channels and large angles. New mill tables and a new electric manipulator for the 35-in. blooming mill, have been ordered, the better to equip it for the handling of large ingots. The complete alteration is expected to cost about $1,250,000. Contracts have been let for the machinery and building, and the actual work of construction on the plant will begin late this year, so that the mill may be ready to produce the heavier rails and sections in the latter part of next winter.

Personal.

Mr. James T. Mackenzie, metallurgist to the American Cast Iron Pipe Company, who is well known for his researches throughout Europe, has had the degree of doctor of science conferred upon him by the University of the South (Tennessee).

Mr. A. W. Bullen, ironfounder, St. John's Road, Hampton Wick, has celebrated his golden wedding. He is one of the original members of the local urban council, and in 1916 was presented with an inscribed silver salver for 21 years' service.

Upon his retirement, after nearly 60 years' service with the firm, Mr. Walter Jones, works manager of the Coalbrookdale Company, Limited, ironfounders, Coalbrookdale, Shropshire, has been presented by his colleagues and employers with an illuminated address and a cheque.

Mr. Joe Hepworth, director of Hepworth & Grandage, Limited, engineers and foundrymen, of Bradford, has accepted election as one of the first two Vice-Presidents of the newly-formed Bradford Gliding Club. Mr. Hepworth, a keen sporting motorist, is greatly interested in the new engineless flying activity, even though he is the head of a firm one of whose main products is automobile cylinders.

Mr. J. E. Torbock, blast-furnace manager at the Margam Works of the British (Guest Keen Baldwins) Iron & Steel Company, Limited, was last week the recipient of a presentation from the officials and workmen employed at the Margam Works. Mr. Torbock joined Messrs. Baldwins, Limited, at Landore, in 1908, in the capacity of manager of the coken-oven and blast-furnace departments. He had previously occupied positions with the Dinsdale Smelting Company, the Cargo Fleet Iron Company and the Pyle and Blaina Works.

Mr. W. L. Hichens, who accepted the chairmanship of the English Electric Company, Limited, in October, 1927, as a temporary arrangement, has resigned that office and retired from the board now that the reconstruction of the company has been completed. Sir Holberry Mensforth has been elected to the board and appointed chairman of the company. Sir Holberry was formerly managing director of Messrs. Bolckow, Vaughan & Company, Limited, and is a director of Messrs. Dorman, Long & Company, Limited, and the Darlington Rolling Mills Company, Limited.

Contracts Open.

Grazeley, August 16.—2,490 yds. of 4-in. cast-iron water main, for the Wokingham Rural District Council. Mr. C. Aldridge, Council Offices, Barkham Road, Wokingham.

Hensol Castle, Glam, August 11.—Water works, including pumping installation, 900 yds. of 4-in. cast-iron main, construction of concrete service reservoir, collecting chamber, etc., for the Glamorgan County Council. Messrs. Thomas & Morgan & Partners, 23, Gelliwastad Road, Pontypridd. (Fee £5 5s., returnable.)

Invercargill, N.Z., September 30.—Centrifugal pumps, motors, etc., for Invereargill City Council. The Department of Overseas Trade. (Reference A.X. 9,946.)

London, S.E., August 28.—38 tons of ferro-manganese and 260 tons of mild-steel plates, for the India Store Department, Belvedere Road, Lambeth, London, S.E.1. (Fee 5s., non-returnable.)

London, S.E., August 29.—Twelve sets of locomotive cylinders and parts for conversion of standard engines, for the India Store Department, Belvedere Road, Lambeth, London, S.E.1. (Fee 5s., non-returnable.)

London, S.W., August 19.—(1) 600 steel tyres; (2) 180 steel superheater flue tubes and 7,080 steel boiler tubes; (3) 7,416 axleboxes for carriages and wagons (cast steel or malleable cast iron); (4) 670 steel tyres for locomotives; and (5) 3,365 helical and 2,865 volute springs, for the Madras and Southern Mahratta Railway Company, 25, Buckingham Palace Road, Westminster, S.W.1. (Fee £1 1s. each, non returnable.)

Reports and Dividends.

Mather & Platt, Limited.—Interim dividend of 5 per cent.

Warner & Company, Limited.—Profit, £9,098; final dividend of 7½ per cent., making 10 per cent. for the year; carried forward, £1,196.

J. Grayson Lowood & Company, Limited.—Net profit, £5,509; brought in, £1,852; to reserve, £2,000; final dividend of 6 per cent., making 9 per cent.; carried forward, £1,981.

Vickers, Limited.—Interim dividends of 2½ per cent., less tax, on the preferred 5 per cent. stock and the 5 per cent. preference shares, and of 2½ per cent., tax free, on the cumulative preference shares.

British Electric Transformer Company, Limited.—Trading profit, £2,929; interest, etc., £4,845; brought in, £11,095; general and specific charges, £57,448; debit balance, £38,579, which is transferred from reserve.

Bengal Iron Company, Limited.—Profit, £271,752; brought in, £55,936; depreciation and colliery sinking fund, £80,265; debenture interest, £63,049; debenture redemption sinking fund, £26,950; written off debenture discount account, £4,550; income-tax reserve, £5,000; preference dividend, £37,500; dividend on the ordinary shares of 2½ per cent., absorbing £39,859; carried forward, £70,513.

Obituary.

Mr. Samuel T. Crush, a director and manager of Messrs. Yarrow & Company, Limited, Scotstoun, Glasgow, has died at the age of 61. He had been associated with the company for nearly half a century.

Mr. William James Thomson, late of Messrs. Thomson & Stewart, ironfounders, King Street, Aberdeen, died recently. Mr. Thomson started the firm of Thomson & Stewart about 40 years ago, taking an active interest until two years ago, when he retired. He was 82 years of age.

New Company.

John Allan & Company (Glenpark), Limited, 258, Glenpark Road, Glasgow.—Capital £18,000. Metal refiners and manufacturers, etc. Directors: Miss L. W. Twaddle, J. R. Twaddle and R. Twaddle.

Telephones: SHEFFIELD 22311 (3 lines) LONDON 1483 Central GLASGOW South 1580 WORKSOP 205 AMBERGATE 7 STOCKSBRIDGE 27 GALSTON 49

"SERVICE FIRST."

MANUFACTURERS & PRODUCERS OF REFRACTORY MATERIALS OF EVERY DESCRIPTION. BRICKMAKERS · QUARRY AND MINEOWNERS CONTRACTORS & EXPORTERS.

GENERAL REFRACTORIES LIMITED

Incorporating THE GENERAL REFRACTORIES CO. LTD. THE MIDLAND REFRACTORIES CO., LTD. THOMAS BROOKE & SONS LTD. WORKSOP BRICK CO., LTD. GUISELEY SILICA CO. LTD.

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KELHAM ISLAND MILLS SHEFFIELD • LOWGROUNDS BRICKWORKS WORKSOP · Notts • BULLBRIDGE BRICKWORKS AMBERGATE · Derbys • GAYTON ROAD MILLS KINGS LYNN • THE BATTS MILLS WOLSINGHAM · Dur • BRACKENMOOR FIRECLAY WORKS · STOCKSBRIDGE • LOUDOUN MILLS GALSTON · Ayrshire

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STEELFOUNDERS

please remember

WE SELL SAND

BUT

WE GIVE SERVICE

Our experience and advice on Sand subjects are freely at your disposal. It may be that we can help you if you give us an opportunity.

NOTE:—EXTRA STRONG "YORKSHIRE SAND" is highly concentrated and will carry more floor or mixing sand than any other sand in the world.

Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—With the opening of the autumn holiday season, the stagnation previously noted in the Cleveland iron market has been further accentuated, and little, if any, improvement can be expected for at least another month ahead. Meanwhile customers with small orders to place are pursuing a most cautious policy. They are showing more and more disinclination to pay ruling rates, but ironmasters adhere to their fixed minimum figures, and second-hands are not in a position to dispose of much iron, as contract conditions with producers prohibit second-hands dealing extensively with principal home consumers, and export demand is quite trifling. Efforts to sell Indian iron to firms on Tees-side have not met with success, founders in this district stating that Indian products are unsuitable for the manufacture of the light castings made in this area. Output of local foundry iron is well taken up, but basic qualities are in only moderate request. Recognised market rates remain: —No. 1 Cleveland, 70s.; No. 3 G.M.B., 67s. 6d.; No. 4 foundry, 66s. 6d.; and No. 4 forge, 66s.

Conditions in the East Coast hematite industry continue unsatisfactory, notwithstanding makers' efforts, by curtailing production, to ensure more stability to markets. Producers are, however, still burdened with embarrassingly heavy stocks, and have to contend with under-selling by merchants, who still hold fairly large parcels, and with severe foreign competition. In the circumstances thus indicated, producers base quotations on ordinary qualities at 71s., and state that cost of output is several shillings above that figure. On the North-West Coast, Bessemer mixed numbers are easier at 70s. per ton at works.

LANCASHIRE.—The position in local markets for pig-iron is again reflected in a much diminished demand, due to unsatisfactory order-books at the majority of the foundries, while there is still an almost general tendency on the part of consumers to give out new contracts very sparingly, forward contract buying being on a very limited scale. Prices are lower, with Staffordshire and Derbyshire No. 3 qualities now quoted at 72s. and Scottish makes at from 93s. to 94s., all per ton delivered local stations.

THE MIDLANDS.—In common with other districts, business throughout the Black Country area is affected by holiday influences, and few transactions have been reported. A further reduction of prices of foundry pig has, however, been announced by Midland ironmasters, the ruling rates now in force being as follow:—No. 3 Northants, 70s.; No. 3 Derbyshire, 73s. 6d.; and No. 3 Staffordshire, also 73s. 6d.; with Scottish brands from 93s. 6d. upwards; all per ton delivered local stations.

SCOTLAND.—Business in the Scottish markets for foundry pig is again reported on a very limited scale, local foundry consumers still complaining of a lack of orders. Prices are, however, upheld at previous levels, No. 3 quality being quoted at 76s. 6d. per ton.

Finished Iron.

Demand for this class of material remains very quiet indeed in connection with most branches of the bar-iron trade. The only section where there is any activity is in marked bars. The makers of these and other high grades of iron are reasonably busy. Staffordshire marked bars are unchanged at £12 10s. at works, and crown iron is offered at between £10 and £10 5s., delivered this district. Orders for nut and bolt iron for the local makers are out of the question except for odd lots for early delivery on account of the low prices ruling for Continental No. 3.

Steel.

At Sheffield the dull state of the steel market is pronounced, and dealings are few and for small quantities. Acid steel billets attract little interest, and so far as basic billets are concerned, soft qualities alone display any activity. Prices are unchanged, and are as follow:—Siemens acid billets, £9 10s.; basic billets, soft, £6 10s.; medium, £7 12s. 6d.; hard, £9 2s. 6d. to £9 12s. 6d.; acid wire rods, £12 to £12 10s.; soft basic wire rods, £8; medium hard, £9 15s. to £10; hard, £10 10s. to £11. Although the demand for ordinary steels continues to tail-off badly, there is an encouraging volume of business in most of the special steels. Overseas business is poor on the whole, but a few foreign railway orders for axles have recently come to hand. In the tinplate market prices are unchanged, with 18s. basis still quoted for coke quality, net cash, f.o.b. Welsh ports.

Scrap.

Markets for foundry scrap material all round continue idle and featureless, easier prices at the moment offering little inducement to buyers in the present conditions of consuming industries. On Tees-side this week heavy ordinary cast-iron scrap was offering at 55s. and heavy machinery quality at 57s. 6d. Ordinary heavy cast-iron scrap is ignored at 55s. delivered, but there have been a few sales of machinery quality at about 57s. 6d. delivered.

Metals.

Copper.—Although fluctuations in warrant copper values during the past week have been confined within comparatively narrow limits, the tendency on the whole points to lower levels in the face of the uncertainty of the American position. Meanwhile the future of the metal remains obscure, but in any case a sustained upward movement is not expected under present conditions.

Closing quotations :—

Cash.—Thursday, £48 3s. 9d. to £48 5s.; Friday, £48 10s. to £48 12s. 6d.; Tuesday, £48 15s. to £48 17s. 6d.; Wednesday, £48 11s. 3d. to £48 12s. 6d.

Three Months.—Thursday, £48 3s. 9d. to £48 5s.; Friday, £48 10s. to £48 12s. 6d.; Tuesday, £48 15s. to £48 16s. 3d.; Wednesday, £48 10s. to £48 12s. 6d.

Tin.—Movements in the market for standard tin recently indicate a steadier tendency, and towards the close a somewhat firmer tone prevailed. The latest announcement by the Tin Producers' Association regarding the measure of support it has received for its restriction proposals has brought a more confident feeling into the market, and fluctuations in prices have been confined within moderate limits.

Official closing prices :—

Cash.—Thursday, £134 12s. 6d. to £134 15s.; Friday, £135 12s. 6d. to £135 15s.; Tuesday, £136 17s. 6d. to £137; Wednesday, £135 10s. to £135 15s.

Three Months.—Thursday, £136 7s. 6d. to £136 10s.; Friday, £137 5s. to £137 7s. 6d.; Tuesday. £138 12s. 6d. to £138 15s.; Wednesday, £137 10s. to £137 15s.

Spelter.—The spelter market has again lost ground, in spite of the reported renewal of the Zinc Cartel at the Ostend meeting of producers. Details of the basis on which production is to be regulated are so far lacking, and a quiet feeling has persisted pending the receipt of further particulars. Meanwhile the galvanisers are still very poorly engaged, and consumption generally is restricted.

Daily fluctuations :—

Ordinary.—Thursday, £16; Friday, £16 1s. 3d.; Tuesday, £16; Wednesday, £15 18s. 9d.

Lead.—The market for soft foreign pig continues to provide the steadiest market among the non-ferrous metals, and recently there has again been very little movement in quoted prices.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £18 5s.; Friday, £18 3s. 9d.; Tuesday, £18 5s.; Wednesday, £18 7s. 6d.

Imported Bolts, Nuts and Rivets.

An Order in Council entitled the Merchandise Marks (Imported Goods) No. 6 Order, 1930, which was made on July 28, requires imported bolts, nuts, rivets, set screws, coach screws and boiler makers' and engineers' studs of iron or steel to bear an indication of origin at the time of sale or exposure for sale in the United Kingdom. The Order will come into force on October 28, 1930.

Draft Regulations for Chrome Plating.

REASONS FOR PROPOSALS.

The Home Office has prepared draft regulations in regard to the protection of those engaged in the practical operations of chrome plating and a discussion on the proposals took place on July 23 at a meeting of the Electro-platers' and Depositors' Technical Society in London. Dr. R. S. Hutton (President) was in the chair, and the object of the meeting was to hear from Dr. S. G. Overton (H.M. Medical Inspector of Factories) an explanation of the reasons that have led to the drafting of the proposals.

It may be said that the effect of the processes involved in chromium plating has been the subject of careful investigation by H.M. Medical Inspectors of Factories, in the course of which 223 persons were examined. Of these, 95 were found to have dermatitis or circumscribed ulcers or scars of old ulcers, nasal changes were observed in 116, perforation of the septum in 37 and ulceration or devitalisation of the mucous membrane in 79. Ulceration of the nasal mucous membrane was seen after only two weeks' employment, and the length of employment of those who showed perforation of the nasal septum varied from six months to four years. These effects, it is stated by the Home Office Inspectors, are caused by the spray carried into the atmosphere by the evolution of the gases from anodes and kathodes, and it is said that this risk can only be eliminated by efficient exhaust ventilation.

Dermatitis, or ulceration of the skin, is produced by direct contact with the chrome solutions. It affects particularly the skin of the hands and workers engaged in placing the articles into, or removing them from, the baths are chiefly affected. Dermatitis and ulceration have also been observed on other parts of the body, in particular the feet, the solution in such cases being splashed from the bath or falling from the articles on removal from the bath and penetrating the footwear. There are also the workers engaged in the subsequent processes, such as de-wiring, swilling and neutralising, and it is proposed that the regulations shall also apply to them. The anodic oxidation process, which is employed for the purpose of preventing erosion of metal, differs in certain ways from the process of chrome plating, in that the article is oxidised and no chrome is deposited. The percentage of chrome acid in the bath is very much smaller, but examination has shown that the same injurious effects are produced on the workers as in the case of chrome plating.

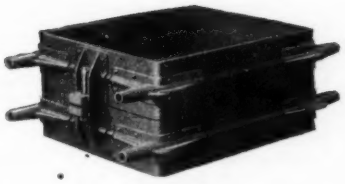
Polishers and finishers engaged on chrome-plating work are subject to the requirements of the Regulations for the Grinding of Metals (Miscellaneous Industries), under which exhaust ventilation is already required. The process, it is pointed out, is a dirty one, and notwithstanding mechanical exhaust, dust from the green "Compo"—mainly composed of green oxide of chrome and wax—is deposited on the skin and in the nostrils. Washing facilities are, therefore, desirable, in addition to the exhaust ventilation already required.

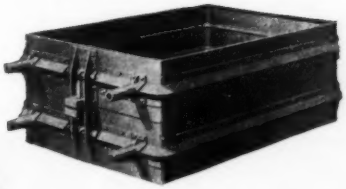
The above constitute the basis upon which the draft regulations have been prepared, and, subject to the consideration of the objections, the regulations will come into force in due course. In the circumstances set out above, the Home Secretary has certified the processes mentioned to be dangerous, and he, therefore, proposes to supplement the general law by means of regulations. The chief requirements are exhaust ventilation, provision of protective clothing, washing facilities, periodic inspections of the hands and forearms and periodic medical examination by the certifying surgeon or by a doctor appointed for the purpose, who is empowered to suspend workers from employment involving contact with the liquids.

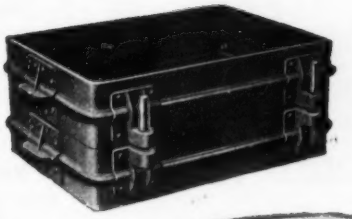
XUM

Sterling

UP-TO-DATE MOULDING BOX EQUIPMENT.







STERLING
ROLLED STEEL
MOULDING BOXES
have been designed for THE MODERN FOUNDRY.

They are light and easy to handle.
Cannot crack or break.
Cannot spring.
Strong, Rigid, Durable and Permanently accurate.

BY ADOPTING STERLING BOXES IN YOUR FOUNDRY,

You will halve your moulding costs. You will increase production per man per hour, and reduce your box maintenance costs. You will turn out more accurate castings and thereby reduce your scrap and reject accounts. You will considerably reduce your fettling costs and put money into your pocket that is now running to waste.

STERLING BOXES save their cost in a few months and are obviously a sound investment for any foundry.

STERLING FOUNDRY SPECIALTIES Ltd.
Agents at:—London, Manchester, Newcastle and Glasgow.
BEDFORD.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	48	11	3
Three months	48	10	0
Electrolytic	51	0	0
Tough	49	15	0
Best selected	50	5	0
Sheets	79	0	0
India	63	0	0
Wire bars	52	2	6
Do. August	52	2	6
Do. September	52	2	6
Ingot bars	52	2	6
H.C. wire rods	54	0	0
Off. av. cash, July	48	6	10½
Do., 3 mths., July	48	0	7½
Do., Sttlmnt., July	48	7	6
Do., Electro, July	53	7	6
Do., B.S., July	53	1	4½
Do., wire bars, July	54	4	6½
Solid drawn tubes			11½d.
Brazed tubes			11½d.
Wire			8½d.

BRASS.

Solid drawn tubes	10½d.
Brazed tubes	12½d.
Rods, drawn	10½d.
Rods, extd. or rlld.	9d.
Sheets to 10 w.g.	8½d.
Wire	8½d.
Rolled metal	8½d.
Yellow metal rods	6½d.
Do. 4 × 4 Squares	7d.
Do. 4 × 3 Sheets	7½d.

TIN.

	£	s.	d.
Standard cash	135	10	0
Three months	137	10	0
English	136	15	0
Bars	139	0	0
Straits	137	0	0
Australian	136	17	6
Eastern	137	15	0
Banca	140	17	6
Off. av. cash, July	134	11	10
Do., 3 mths., July	136	6	5
Do., Sttlmt., July	134	12	4

SPELTER.

	£	s.	d.
Ordinary	15	18	9
Remelted	14	5	0
Hard	12	15	0
Electro 99.9	18	7	6
English	16	7	6
India	14	5	0
Zinc dust	22	0	0
Zinc ashes	4	0	0
Off. aver., July	16	9	5
Aver., spot, July	16	3	5

LEAD.

	£	s.	d.
Soft foreign ppt.	18	7	6
English	19	10	0
Off. average, July	18	2	2
Average spot, July	18	3	2

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	26	0	0
Do. V.M. ex-whf.	25	10	0
Rods	30	0	0
Boiler plates	22	0	0
Battery plates	23	0	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	38	0	0
Chinese	26	10	0
Crude	20	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	22	10	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro-silicon—			
25%	7	17	6
45/50%	11	10	0
75%	18	0	0
Ferro-vanadium—			
35/50%	12/8 lb. Va.		
Ferro-molybdenum—			
70/75% c. free	4/2 lb. Mo.		
Ferro-titanium—			
23/25% carbon-free	11½d. lb.		
Ferro-phosphorus, 20/25%	£16	0	0
Ferro-tungsten—			
80/85%	2/5½ lb.		
Tungsten metal powder—			
98/99%	2/8½ lb.		
Ferro-chrome—			
2/4% car.	£30	10	0
4/6% car.	£23	10	0
6/8% car.	£22	7	6
8/10% car.	£22	0	0
Ferro-chrome—			
Max. 2% car.	£33	10	0
Max. 1% car.	£36	17	6
Max. 0.70% car.	£37	17	6
70% carbon-free	11d. lb.		
Nickel—99% cubes, or pellets	£175	0	0
Ferro-cobalt	9/7 lb.		
Aluminium 98/99%	£95	0	0
Metallic chromium—			
96/98%	2/7 lb.		
Ferro-manganese (net)—			
76/80% loose	£11 0 0 to £11	15	0
76/80% packed	£12 0 0 to £12	15	0
76/80% export	£11 0 0 to £11	15	0
Metallic manganese—			
94/96% carbonless	1/4 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0	2	2
Finished bars, 18% tungsten	£0	3	0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 1/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ½ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

South Wales—	£	s.	d.	£	s.	d.
Heavy steel				2	15	0
Bundled steel and shrngs.	2	10	0 to	2	13	0
Mixed iron and steel	2	7	6 to	2	10	0
Heavy cast iron	2	14	0 to	2	15	0
Good machinery for foundries	2	15	0 to	2	17	6
Cleveland—						
Heavy steel				2	7	6
Steel turnings				2	0	0
Cast-iron borings				1	15	0
Heavy forge				3	7	6
W.I. piling scrap				3	3	0
Cast-iron scrap	2	15	0 to	2	17	6
Midlands—						
Ord. cast-iron scrap				2	12	6
Heavy wrought				3	5	0
Steel turnings				1	7	0
Scotland—						
Heavy steel				2	10	0
Ordinary cast iron				2	18	0
Engineers' turnings				1	18	6
Cast-iron borings				1	17	6
Wrought-iron piling				3	11	6
Heavy machinery				3	3	0

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	44	0	0
Brass	32	10	0
Lead (less usual draft)	16	5	0
Tea lead	12	15	0
Zinc	9	10	0
New aluminium cuttings	56	0	0
Braziery copper	41	0	0
Gunmetal	43	0	0
Hollow pewter	100	0	0
Shaped black pewter	75	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	70/-
Foundry No. 3	67/6
Foundry No. 4	66/6
Forge No. 4	66/-
Hematite No. 1	71/6
Hematite M/Nos.	71/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	83/6
„ d/d Birm.	88/6
Midlands—	
Staffs. common*	—
„ No. 4 forge*	68/6
„ No. 3 fdry.*	73/6
Shrops. basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	65/-
„ fdry. No. 3*	70/-
Derbyshire forge*	68/6
„ fdry. No. 3*	73/6
„ basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	79/-
„ No. 3	76/6
Hem. M/Nos.	79/6
Sheffield (d/d district)—	
Derby forge	63/6
„ fdry. No. 3	68/6
Lincs. forge	—
„ fdry. No. 3	70/-
E.C. hematite	83/6
W.C. hematite	86/6
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	67/-
„ fdry. No. 3	72/-
Staffs foundry No. 3	72/-
Dalzell, No. 3 (special)	105/- to 107/6
Summerlee, No. 3	93/- to 94/-
Glengarnock, No. 3	—
Gartsherrie, No. 3	93/- to 94/-
Monkland, No. 3	93/- to 94/-
Shotts, No. 3	93/- to 94/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (or.)				10	15	0
Nut and bolt iron	9	0	0 to	9	5	0
Hoops				10	15	0
Marked bars (Staffs) f.o.t.				12	10	0
Gas strip				10	15	0
Bolts and nuts, ¾ in. × 4 in.				15	5	0
Steel—						
Ship plates	8	15	0 to	8	17	6
Boiler plts.	9	15	0 to	10	10	0
Chequer plts.				10	12	6
Angles				8	7	6
Tees				9	7	6
Joists				8	10	0
Rounds and squares, 3 in. to 5½ in.				9	7	6
Rounds under 3 in. to ¾ in. (Untested)				7	15	0

and upwards

Flats—8 in. wide and over	8	12	6
„ under 8 in. and over 5 in.	8	17	6
Rails, heavy	8	10	0
Fishplates	12	0	0
Hoops (Staffs)	9	5	0 to 9 15 0
Black sheets, 24 g.	9	12	6 to 9 15 0
Galv. cor. shts., 24g.	11	17	6
Galv. fencing wire, 8g. plain	12	0	0
Billets, soft	5	17	6 to 6 5 0
Billets, hard	7	10	0 to 8 0 0
Sheet bars	5	12	6 to 6 0 0
Tin bars			6 0 0

PHOSPHOR BRONZE.

Per lb. basis.

Strip	1/0½
Sheet to 10 w.g.	1/1½
Wire	1/1½
Rods	1/1½
Tubes	1/5½
Castings	1/1½

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

per lb.

Ingots for raising	8d. to 1/2
Rolled—	
To 9 in. wide	1/2 to 1/8
To 12 in. wide	1/2½ to 1/8½
To 15 in. wide	1/2½ to 1/8½
To 18 in. wide	1/3 to 1/9
To 21 in. wide	1/3½ to 1/9½
To 25 in. wide	1/4 to 1/10
Ingots for spoons and forks	8d. to 1/4½
Ingots rolled to spoon size	11d. to 1/7½
Wire round—	
3/0 to 10 G.	1/5½ to 2/0½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	19.76
No. 2 foundry, Valley	18.00
No. 2 foundry, Birm.	14.00
Basic	19.76
Bessemer	20.26
Malleable	20.26
Grey forge	19.26
Ferro-mang. 80%	94.00
O.-h. rails, h'y, at mill	43.00
Billets	31.00
Sheet bars	31.00
Wire rods	36.00
	Cents.
Iron bars, Phila.	2.09
Steel bars	1.65
Tank plates	1.65
Beams, etc.	1.65
Skelp, grooved steel	1.70
Skelp, sheared steel	1.70
Steel hoops	1.95
Sheets, black, No. 24	2.45
Sheets, galv., No. 24	3.10
Sheets, blue an'l'd, No. 13	2.15
Wire nails	2.05
Plain wire	2.30
Barbed wire, galv.	2.80
Tinplates, 100-lb. box	$5.25

COKE (at ovens).

Welsh foundry	25/- to 27/6
„ furnace	17/- to 21/-
Durham and Northumberland—	
„ foundry	14/6 to 15/6
„ furnace	14/- to 14/6
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box		18/-
„	28×20 „		36/-
„	20×10 „		26/-
„	18¾×14 „		18/9
C.W.	20×14 „		16/6
„	28×20 „		33/6
„	20×10 „		23/6
„	18¾×14 „		17/-
Terneplates	28×20		32/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0	to	£7	10 0
Bars, hammered, basis	£17	10	0	to	£18	10 0
Bars and nail-rods, rolled, basis	£15	17	6	to	£16	15 0
Blooms	£10	0	0	to	£12	0 0
Keg steel	£32	0	0	to	£33	0 0
Faggot steel	£20	0	0	to	£24	0 0
Bars and rods dead soft, steel	£11	0	0	to	£14	0 0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Over ¼ in. up to 6 in.

	Tubes.	*Fittings.*
Gas	62½%	47½%
Water ..	58½%	42½%
Steam ..	55%	37½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
July	31 ..	48	3	9	dec.	3/9
Aug.	1 ..	48	10	0	inc.	6/3
,,	4 ..	——			——	
,,	5 ..	48	15	0	inc.	5/–
,,	6 ..	48	11	3	dec.	3/9

Electrolytic Copper.

		£	s.	d.		
July	31 ..	51	15	0	inc.	10/–
Aug.	1 ..	51	0	0	dec.	15/–
,,	4 ..	——			——	
,,	5 ..	51	0	0	No change	
,,	6 ..	51	0	0	,,	,,

Standard Tin (cash).

		£	s.	d.		
July	31 ..	134	12	6	inc.	5/–
Aug.	1 ..	135	12	6	,,	20/–
,,	4 ..	——			——	
,,	5 ..	136	17	6	inc.	25/–
,,	6 ..	135	10	0	dec.	27/6

Tin (English ingots).

		£	s.	d.		
July	31 ..	135	10	0	inc.	10/–
Aug.	1 ..	137	0	0	,,	30/–
,,	4 ..	——			——	
,,	5 ..	138	0	0	inc.	20/–
,,	6 ..	136	15	0	dec.	25/–

Zinc Sheets (English).

		£	s.	d.		
July	31 ..	26	0	0	No	change
Aug.	1 ..	26	0	0	,,	,,
,,	4 ..	——			——	
,,	5 ..	26	0	0	No	change
,,	6 ..	26	0	0	,,	,,

Spelter (ordinary).

		£	s.	d.		
July	31 ..	16	0	0	dec.	2/6
Aug.	1 ..	16	1	3	inc.	1/3
,,	4 ..	——			——	
,,	5 ..	16	0	0	dec.	1/3
,,	6 ..	15	18	9	,,	1/3

Lead (English).

		£	s.	d.		
July	31 ..	19	15	0	No	change
Aug.	1 ..	19	15	0	,,	,,
,,	4 ..	——			——	
,,	5 ..	19	15	0	No	change
,,	6 ..	19	10	0	dec.	5/–

AVERAGE MONTHLY PRICES OF STEEL BOILER PLATES IN ENGLAND.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1895	5 15 0	5 15 0	5 12 6	5 12 6	5 15 0	5 17 6	5 15 0	5 17 6	6 0 0	6 0 0	6 2 6	6 0 0	5 16 10½
1896	6 0 0	6 0 0	6 2 6	6 2 6	6 2 6	6 0 0	6 0 0	6 0 0	6 0 0	6 2 6	6 10 0	6 10 0	6 2 6
1897	6 10 0	6 10 0	6 10 0	6 7 6	6 2 6	6 2 6	6 5 0	6 0 0	6 0 0	6 0 0	6 7 6	6 10 0	6 5 5
1898	6 10 0	6 8 9	6 8 9	6 10 0	6 15 0	6 18 9	6 17 6	6 17 6	7 2 6	6 15 0	7 0 0	**7 5 0**	6 15 8½
1899	7 5 0	8 0 0	8 2 6	8 2 6	8 5 0	8 5 0	8 12 6	8 12 6	8 15 0	8 15 0	9 2 6	9 5 0	8 17 8½
1900	9 5 0	9 5 0	9 7 6	9 10 0	9 12 6	10 5 0	10 5 0	10 5 0	10 5 0	10 0 0	9 15 0	9 15 0	9 15 10
1901	9 5 0	9 5 0	8 15 0	8 10 0	8 10 0	7 10 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	8 3 11
1902	7 7 6	7 0 0	7 12 6	7 12 6	7 12 6	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 9 7
1903	7 10 0	7 10 0	7 15 0	7 5 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	6 17 6	7 3 11½
1904	6 12 6	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 11½
1906	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 17 6	6 10 0	7 5 0	8 0 0	8 0 0	7 1 3
1906	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 0 10
1907	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 0 0	8 0 0	8 8 4
1908	7 10 0	7 10 0	7 10 0	7 5 0	7 5 0	7 5 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 3 9
1909	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	6 15 0	6 15 0	6 15 0	7 0 0	7 0 0	7 0 0	7 0 0	6 18 9
1910	7 0 0	7 0 0	7 1 3	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 10 0	7 10 0	7 10 0	7 5 1
1911	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 14 0	7 10 4
1912	7 18 9	8 0 0	8 0 0	8 7 6	8 10 0	8 10 0	8 10 0	8 15 0	8 16 3	9 0 0	9 2 0	9 5 0	8 11 2½
1913	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	8 19 0	8 15 0	8 5 0	7 15 0	7 15 0	8 17 0
1914	7 15 0	7 15 0	7 15 0	7 13 9	7 10 6	7 5 0	7 0 0	8 0 0	8 2 6	8 5 0	8 5 0	8 5 0	7 15 11½
1915	8 14 0	9 10 0	9 17 6	10 10 0	10 10 0	11 0 0	11 0 0	11 0 0	11 0 0	11 4 0	12 0 0	13 0 0	10 15 5½
1916	13 0 0	13 0 0	13 0 0	12 15 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 12 11
1917	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1918	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0
1919	13 0 0	15 0 0	15 0 0	15 0 0	19 5 0	19 17 6	21 0 0	21 10 0	21 10 0	21 10 0	21 15 0	23 10 0	18 9 9
1920	26 0 0	28 0 0	28 5 0	28 10 0	29 5 0	30 0 0	30 0 0	30 10 0	30 10 0	31 0 0	31 0 0	31 0 0	29 9 2
1921	30 5 0	29 0 0	25 0 0	25 0 0	25 0 0	23 0 0	21 0 0	20 10 0	19 0 0	17 10 0	16 0 0	14 16 0	22 1 9
1922	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	13 1 8	13 10 0	12 15 0	12 10 0	12 10 0	12 10 0	12 6 0	13 10 9
1923	12 8 9	13 6 0	14 0 0	14 0 0	14 0 0	14 0 0	13 12 6	13 0 0	13 0 0	13 0 0	13 0 0	13 10 0	13 9 1½
1924	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	14 0 0	14 0 0	13 11 0	13 5 0	13 5 0	13 10 11
1925	13 5 0	13 5 0	13 5 0	13 1 0	12 15 0	12 15 0	12 15 0	12 15 0	12 7 6	11 14 0	11 10 0	11 10 0	12 11 5½
1926	11 10 0	11 10 0	11 10 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 5 0	11 6 3
1927	11 5 0	11 5 0	11 5 0	11 5 0	11 2 6	11 0 0	11 0 0	11 0 0	10 16 0	10 10 0	10 10 0	10 10 0	10 19 0½
1928	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0
1929	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 5 0	10 1 3	10 1 3	10 1 3	10 1 7	10 6 8½
1930	10 2 9	10 3 5½	10 3 9	10 3 9	10 3 6	10 2 6	10 2 6	—	—	—	—	—	—

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PETER—WITH ONE EXCEPTION

With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun, and on occasions—be it admitted—of naughtiness. Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice-Two"; difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception. Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

Would you like to know more about him? How, in spite of his "One Exception," he is being educated and, when older, technically trained and usefully employed.

There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.

Here's a suggestion. Your eyesight is worth 3d. a year to you. Send Peter and his handicapped pals 3d. for every year you've had it. Now, please, in case it slips your memory. Good idea?

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